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TS-930S

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The TS-930S is loaded with all the special features that you always wanted in an HF transceiver. Full coverage of the 160 through 10 meter bands, including the new WARC frequencies, (easily modified for HF MARS), plus a general coverage receiver that can tune any frequency from 150 kHz to 30 MHz. Operation in the SSB, CW, FSK, and AM modes, with selectable full or semi CW break-in. All solid-state, with 250 watts PEP input on SSB, CW, FSK, and 80 watts input on AM. SWR/power meter. Triple final protection circuits plus two cooling fans built-in. 10-Hz step synthesized frequency control. Available with optional automatic antenna tuner built-in, another industry first! Dual digital VFO's. Eight memory channels that store both frequency and band information, with internal battery back-up, (batteries not supplied). Dual mode adjustable noise blankers, especially effective in eliminating "woodpecker" type interference. SSB IF slope tuning, for maximum rejection of interference. CW variable bandwidth, with pitch and sidetone control. IF notch filter. Tuneable audio peaking filter. Unique six digit white fluorescent tube digital display is easy-on-the-eyes during those long contests. RF speech processor, for higher average "talk-power." SSB monitor circuit. 4-step RF attenuator. VOX. 100-kHz marker. AC power supply built-in, 120, 220, or 240 VAC.

TS-930S Optional Accessories: AT-930 automatic antenna tuner, SP-930 external speaker, with selectable audio filters, YG-455C-1 (500 Hz), YG-455CN-1 (250 Hz), YK-88C-1 (500 Hz) CW filter, YK-88A-1 (6 kHz) AM filter, all plug-in type. SO-1 commercial stability TCXO, MC-60A deluxe desk microphone, MC-80 and MC-85 communications microphones, MC-42S mobile hand microphone, TL-922A linear amplifier (not for CW QSK), SM-220 station monitor, PC-1A phone patch, SW-2000 SWR/power meter, 160 ~ 6 meter, SW100A SWR/power/volt meter 160-2m HS-4, HS-5, HS-6, and HS-7 headphones.

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More information on the TS-930S is available from authorized dealers of Trio-Kenwood Communications,
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TS-830S

TS-830S...a "top notch" field proven performer.

The TS-830S is the HF transceiver that delivers the performance the others can only talk about.

Kenwood's TS-830S offers you every conceivable operating feature built-in for 160-10 meters, including the WARC bands. Key operating features such as wide receiver dynamic range, variable band width tuning, notch filter, adjustable noise-blanker, IF shift (passband tuning), and receive capability of WWV on 10 MHz, have established the TS-830S as the first choice of the serious Amateur.

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Yes, all these features along with unprecedented reliability have made the field-proven TS-830S truly "top notch."

Optional accessories:

- SP-230 external speaker.
- VFO-230 remote digital VFO-with five memories, digital display.
- VFO-240 remote analog VFO.
- AT-230 antenna tuner.
- YG-455C (500 Hz) or YG-455CN (250 Hz) CW filter for 455 kHz IF.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filter for 8.83 MHz IF.
- KB-1 deluxe heavyweight knob.

14.215.0
KENWOOD TS-830S
HF SSB TRANSCEIVER

TS-530SP

TS-530SP..."Cents-ational" in performance and value.

No other HF transceiver gives you all these features at such an affordable price.

The TS-530SP covers 160-10 meters, LSB, USB, CW, including WARC bands and it also receives WWV on 10 MHz.

When you turn on your TS-530SP, the IF shift tunes out interfering signals, and the tunable audio notch filter also helps eliminate QRM. Your frequency is displayed in six digits by the fluorescent tube display, with an analog dial for added convenience. Other key features include wide receiver dynamic range, narrow/wide filter selection for CW and/or SSB, built-in speech processor for extra talk power, adjustable noise-blanker and RIT/XIT to allow independent fine-tuning of receive or transmit frequencies. All this along with two 6146B's in the final to allow for lasting, dependable operation.

The TS-530SP, solid dependability at a price everyone can afford!

Optional accessories:

- SP-230 external speaker with selectable audio filters.
- VFO-240 remote analog VFO.
- VFO-230 remote digital VFO.
- MC-50 desk microphone.
- AT-230 antenna tuner/SWR/power meter.
- KB-1 deluxe VFO knob.
- YK-88C (500 Hz) or TK-88CN (270 Hz) CW filter.
- YK-88SN (1.8 kHz) narrow SSB filter.

More information on the TS-830S and TS-530SP is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

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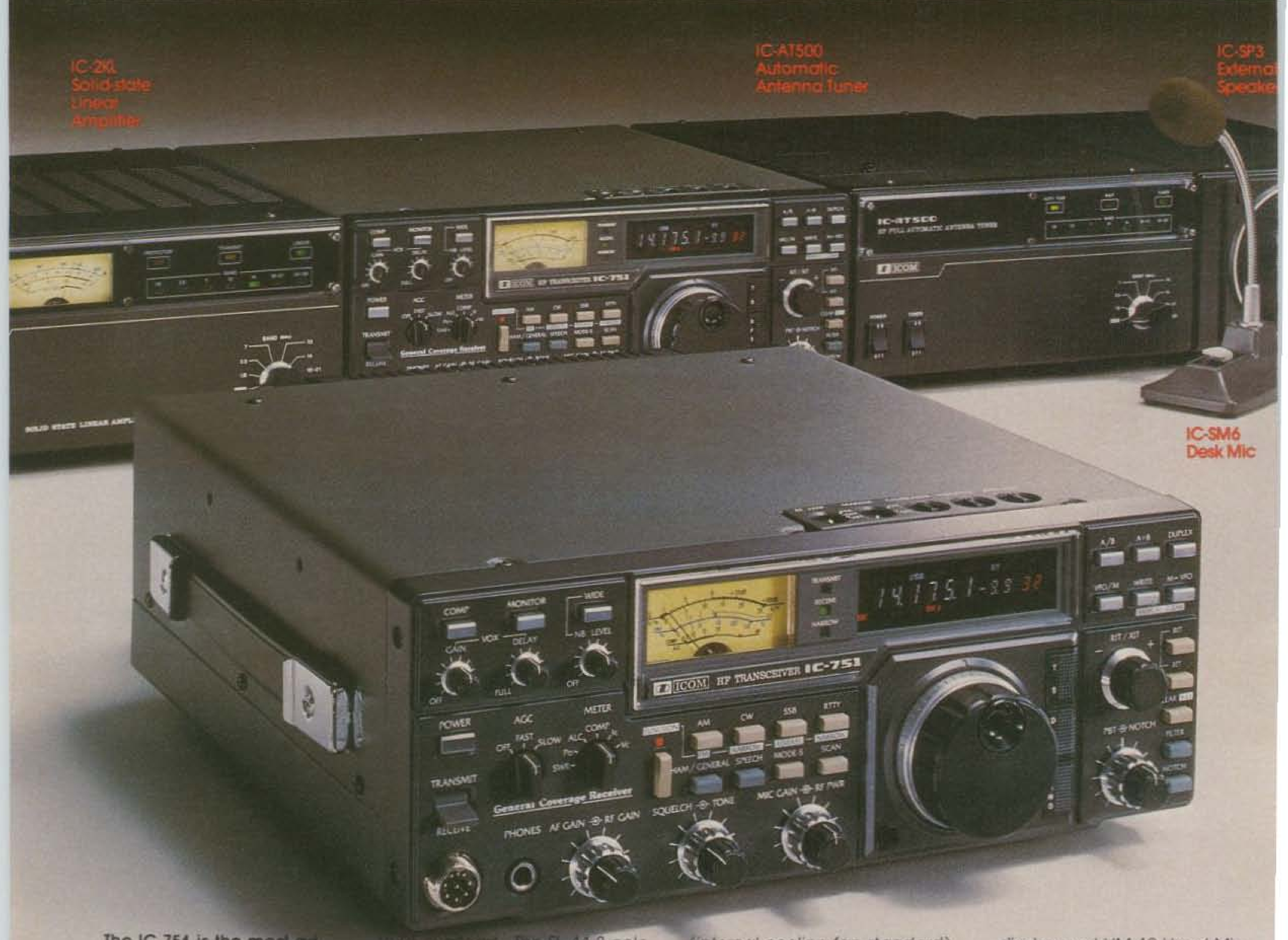
KENWOOD TS-530SP
HF TRANSCEIVER

ICOM IC-751

The New Standard of Comparison



The IC-751 is the most advanced amateur HF transceiver available on the market today... the new standard of comparison.

Receiver. ICOM's 100KHz — 30MHz general coverage receiver with a specially designed DFM (Direct Feed Mixer) utilizes FETS in the receiver front end which gives extremely low intermodulation distortion, ±19dBm intercept point, and a high dynamic range, 105dB. With cascaded filters, the IC-751 is virtually immune to RF overload. The FL-44 8-pole crystal in the third IF is standard and provides exceptional receiver selectivity.

Transmitter. An extremely low-noise PLL and conservative transmitter design give extremely low distortion products (−38dBm, third order) for a crystal clear transmit signal. A microphone tone control is provided to personalize the set to your particular voice. The 9 band solid-state transmitter is also a full 100% duty cycle (internal cooling fan standard) rated. For the CW operator, semi break-in or full QSK is possible.

32 Memories. An ultra versatile memory system allows storage of frequency and mode in each of the 32 memories. Data may be transferred from VFO to memory or from memory to VFO.

Standard Features. FM, FL-44A 455KHz high-grade SSB filter, SSB and FM squelch, built-in marker unit, convenient large controls, a new high-visibility fluorescent display and HM-12 Hand Mic.

Options and Accessories. Voice synthesizer, high stability master reference crystal, a wide range of CW filters, an external IC-PS15 or PS30 power supply, an internal IC-PS35 power supply, CT-10 computer interface unit, RC10 keyboard frequency control ler, IC-2KL solid-state linear ampli fier (160 — 15 meters), IC-AT500 automatic antenna tuner, IC-SP3 external speaker and IC-SM6 desk mic.

IC-PS30 System Power Supply.
The IC-PS30 25 Amp Switching Power Supply consolidates your power requirements by supplying up to four pieces of ICOM equipment, eliminating the need for independent AC power supplies for each. The IC-PS30 is designed to match all of ICOM's amateur equipment.

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CQ
ANTENNA SPECIAL

ON THE COVER: Wilse Morgan, KL7CQ, is a ham with style. A few years ago he made our cover with a hot-air balloon antenna party, and this year he used a helicopter to get his antenna up.

AUGUST 1984 **VOL. 40, NO. 8**

FEATURES

A CQ EXCLUSIVE INTERVIEW WITH: WILLIAM J. HALLIGAN, W9AC/W4AK, FOUNDER, HALLICRAFTERS INC. . . . . Dr. Theodore J. Cohen, N4XX 13

AN AUTOMATIC ANTENNA SELECTOR FOR THE KENWOOD TS-430S Ed Solov, K2SE 18

HOW TO BUILD A PLYWOOD TOWER. . . . . Bill Greene, Jr., WA2JHD 25

CQ REVIEWS: THE CUSHCRAFT A4 TRIBANDER 10, 15, 20 METER BEAM. . . . . John J. Schultz, W4FA 28

EXPLORING THE VAGARIES OF TRAPS. . . . . Cornelio Nouel, KG5B 32

DISSECTING LOOP ANTENNAS TO FIND OUT WHAT MAKES THEM TICK Roy A. Neste, W0WFO 36

CQ REVIEWS: THE ICOM R71A GENERAL-COVERAGE RECEIVER Lew McCoy, W1ICP 38

HOW TO DESIGN A REAL ESTATE EFFICIENT ANTENNA FARM, PART I Michael Joyce, N6ML 44

CQ REVIEWS: THE MFJ-202B R.F. NOISE BRIDGE John J. Schultz, W4FA 50

DATELINE . . . WASHINGTON, D.C.: THE INS AND OUTS OF THE WASHINGTON SCENE. . . . . Dr. Theodore J. Cohen, N4XX 56

CQ SHOWCASE: NEW AMATEUR PRODUCTS. 60

RETAINING THE MAGNETIC CHARACTERISTICS OF MOBILE ANTENNA MOUNTS. . . . . Carl S. Zelich, AA4MI 62

1984 CQ WW WPX S.S.B. CONTEST HIGH-CLAIMED SCORES. 64

THE W4TWW COAXIAL INVERTED "L" ANTENNA FOR 160 METERS Coleman B. Rowland, W4TWW, and James E. McQueen, Jr., WB4LJP 72

THE WORLD OF IDEAS: HIGHLIGHTING OUR NEW OSCAR 10 SATELLITE. . . . . Dave Ingram, K4TWJ 74

CQ REVIEWS: THE LANCE JOHNSON ENGINEERING GP-1 VERTICAL ANTENNA MOUNT. Lew McCoy, W1ICP 84

ANTENNAS: READER RECAP, PART II. . . . . Karl T. Thurber, Jr., W8FX 86

NOVICE: FACTS FOR PROSPECTIVE NOVICES. . . . . Bill Welsh, W6DDB 96

THE SKY PLANE ANTENNA. . . . . Jerry Swank, W8HXR 108

TICKET TALK: INFO ON AMATEUR RADIO LICENSING Dick Bash, KL7IHP 110

1984 CQ 160 METER CONTEST (C.W. AND S.S.B.) HIGH-CLAIMED SCORES. . 113

DEPARTMENTS

AMATEUR RADIO LICENSE REQUIREMENTS. 9

AWARDS: STORY OF THE MONTH—RON SUNDSBOE, WA0MQM Dorothy Johnson, WB9RCY 78

DX: BOUVET OPERATION IN THE WORKS. . . . . Hugh Cassidy, WA6AUD 100

PROPAGATION: DX CHARTS FOR AUG. 15 THROUGH SEPT. 15 George Jacobs, W3ASK 114

CONTEST CALENDAR: ANNOUNCING A NEW CQ WW DX CONTEST CATEGORY—TEAM CONTESTING, CONTESTS FOR AUG. AND EARLY SEPT. . . . . Frank Anzalone, W1WY 118

ZERO BIAS. 4

OUR READERS SAY. 8

ANNOUNCEMENTS 71

HAM SHOP. 124

Zero Bias

AN EDITORIAL

This month we present everyone's favorite topic: antennas. The beauty of antennas is that no matter what you're using you can always think of what you should have used instead. For every theory or configuration there are contrary data, and even if deep down you believe that someone is completely wrong in his approach, you still have to realize that almost anything will radiate after a fashion. Our Antenna Specials are great platforms for ideas and projects that amateurs have tried and have made work.

If you've never built an antenna, then you have missed out on one of amateur radio's simpler pleasures. Technology has surpassed the average amateur's ability to build his own transmitter, receiver, or transceiver. Regardless of the philosophical implications of that statement, it simply is the way it is. We have a long way to go in that respect when it comes to antennas. I think that once you've "rolled a few" of your own, used them, and modified them, you get a different perspective of or appreciation for what went into some of the commercially available models.

Around-the-World Flight Delayed

The attempt to break the world record for piston-driven aircraft has been delayed by a month or so. Glen A. Davis, WA2PAZ, and Dr. Ron Apfelbaum, K2PQS, will stand down for a while, as their original flight plan called for flying down the Persian Gulf. As of this writing things there are still quite unsettled, and it might not be the best idea to tempt fate by flying a small aircraft through that area. We'll see what the end of August brings.

Travels with CQ

As the weather warms up, the hamfest season goes into top gear. This year we went from winter to summer with no apparent spring. The hamfest season had no winter thaw or budding spring either. Each event we attended was considerably bigger and far more active than the same show in previous years. The old-time enthusiasm is back in full swing, and I'm glad to say it is growing.

In mid-May Arnie and I finally made it to Rochester for the big one-day hamfest. I hadn't been there in a couple of years, and frankly I didn't expect the size of the crowd nor the enthusiasm. Our table was picked clean of merchandise by mid-afternoon, and I had a list of stuff to ship the following Monday when we returned to the office. They had the usual big fleamarket with a couple of good buys. The Metroplex gang came up to give exams, and everything went off like clockwork. For Arnie and me the up mood started with the flight to Rochester. Besides Arnie and me, I think the only other English-speaking passenger on that flight was the ARRL's Steve Mendelsohn, WA2DHF. Everyone else seemed to be either Italian or German, and they all were speaking exuberantly in their native tongues. It turned out to be a Sister City Program with Rochester, and they were looking forward to a big party.

That same weekend Dick and Herb went to the BirmingHamfest. Dick was one of the judges in the hamfest's annual homebrew contest. They had quite a few entrants this year, and I understand that the judging got a bit hectic. The mood and economy of the area have steadily been improving over the past year or so, and amateur radio involvement has risen, reflecting the positive change.

About two weeks later Dick, Jack, and I were at the Dallas HamCom. This one has had steady growth to the point where the facilities have to be changed. There was talk of a new location possibly for next year. In case you missed it, this one has two floors of exhibit area plus an indoor and outdoor fleamarket.

We left New York during the monsoon season (8 inches of rain in 5 days) and gratefully came down in sunny Dallas to dry off. The weather was beautiful—not too hot and not too humid. As usual the automobile traffic on the parkways was heavier than we have here. Lew McCoy, W1ICP, and Carl Dane, W1FXK, flew in to join us and help man the *CQ* booth. Lew and Carl used to put on the Hartford show. When Carl retired he moved to El Paso, which is only a several hour drive from Silver City, where Lew lives. We coaxed Carl out of El Paso to help us at the Dayton Hamvention this year, too, and we expect to have him help us at several other hamfests.

Since we returned, New York has had the kind of weather we thought we'd find in Dallas. It has been hot (mid to upper 90's) and very humid. Even though this is an Antenna Special issue, it's been too hot to even think of either climbing on the roof or up a tower. Perhaps by the cover date (August) it will cool off enough for you to utilize some of the material within this issue. I know Dick has some antenna plans set for August, as August is usually a month in which we can stay home to catch up on work around the house and reacquaint ourselves with our families.

It's Back

At almost every show we attend and via the mail several times a week we get queried about Paul Lee's *Vertical Antenna Handbook*. "Where can I get a copy?" "Why don't you bring it back?" "Do you know where I can borrow one?" Well, I'm glad to say that not only is it back, but it's even better than the original. Paul has added material, including a section on 160 meters, one of the hottest and fastest growing bands in amateur radio. This week the new edition will debut at the Atlanta Hamfest. It is on sale, available for immediate delivery from our *CQ* Book Shop, for $9.95 plus postage.

The Move Is On

Not only is the intrepid *CQ* team on the move, but it turns out that the *CQ* Contest Committee Directors (three-quarters of them, anyway) are picking up and moving. Larry Brockman, N6AR, is moving from California to Florida; Bob Cox, K3EST, is moving from Virginia to California, and Steve Bolia, N8BJQ, is moving from Ohio to California. So far, I'm glad to say that Don McClenon, N4IN, our 160 Meter Contest Director, is staying where he is. Therefore, for two of our three contests sending in logs this year may be a problem. In order to head off any confusion, send all DX Contest and WPX Contest logs to the *CQ* offices here in Hicksville, NY. Tell any DX stations or other contesters who may not see *CQ* (there may be a few) to send their logs here, too. We will get them to the right people.

With regard to logs, it is not too early to send in for your *CQ* WW DX logs. Avoid the last-minute rush this year and send in early. It's not a pretty sight to see all of us sitting in a circle on the floor stuffing envelopes assembly-line fashion the week before the contest. Log requests should have an s.a.s.e. with appropriate return postage or an envelope with a few IRCs with the return QTH. Requests with just call letters get the lowest priority, and I mean very low. Next up are the requests with no envelope or any requests hard to read. Also, when you send in your completed logs, please do not include subscription info or questions about articles, as the logs are not opened here. Logs received here are forwarded to the appropriate Contest Director, so it may be a couple of months before your log is opened and looked at. Remember also to mark C.W. or S.S.B. on the envelope.

73, Alan, K2EEK

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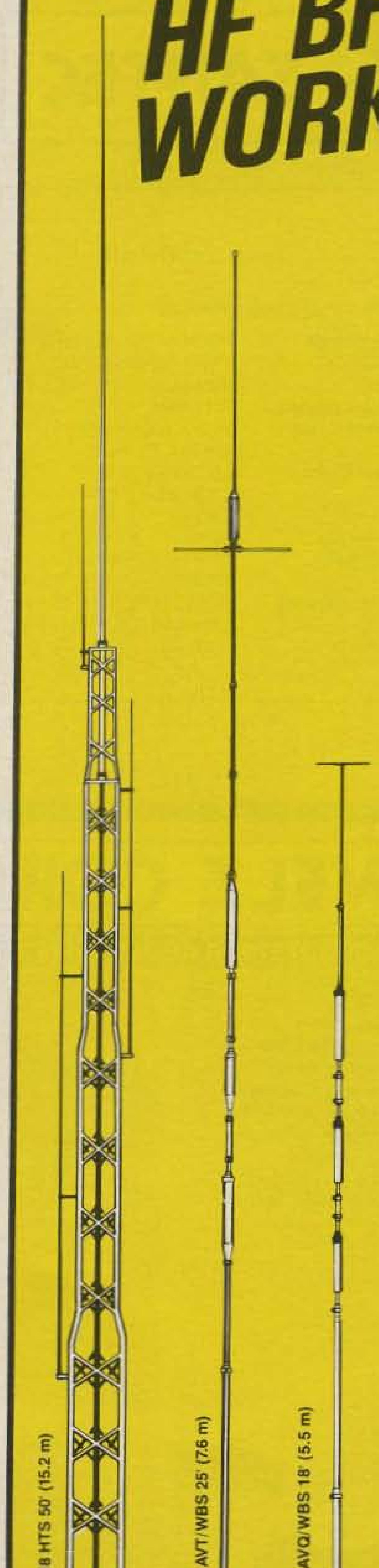

Hy-Gain broadband vertical antennas load the new auto-tune solid state rigs, require minimal space and provide low angle radiation without the expense or the problems of support structures.

18AVT/WBS (80-10 meters) The most successful vertical antenna of all and for good reasons. Broadband performance covers the 40, 20, 15 and 10 meter bands in their entirety. Automatic 5 band switching is accomplished by mechanically superior, highly efficient factory tuned Hy-Q traps with large coils for consistent performance at 2:1 or lower VSWR on 40-10 meter band edges; bandwidth on 80 meters is approximately 40 kHz with VSWR below 2:1. A factory tuned matching network for 50 ohms impedance is dc grounded for lightning protection and reduced precipitation static. The mechanical integrity of this antenna is so stable that performance does not change with the weather. The 18AVT withstands winds to 80 mph (128 km/h) without guying. All stainless steel hardware is included.

14AVQ/WBS (40-10 meters) Offers very similar construction and the same excellent broadband performance as 18AVT over the entire 40, 20, 15 and 10 meter bands; automatic band switching with mechanically superior large-coil Hy-Q traps and very low angle radiation pattern. The smaller, low visibility size also makes the 14AVQ very suitable for roof mounting. The optional 14RMQ roof mounting kit includes base plate, mast and radial/guy wires. All antenna hardware is stainless steel.

18 HTS (80-10 meters. 160 meters with optional loading coil) The superb reliability of the 18 HTS is manifest in installations now over 20 years old. And, with the improvements we made over the years, the 18HTS is now better than ever. Automatic band selection is achieved through a unique stub decoupling system which effectively isolates various sections of the antenna so that an electrical ¼ wavelength (or odd multiple ¼ wavelength) exists on all bands. For example, outstanding broadband performance on 20, 15 and 10 meters is achieved with an extended ¾ wave collinear. On 80 meters bandwidth is approximately 250 kHz at 2:1 VSWR. With the optional base loading coil exceptional performance is also provided at 160 meters. The galvanized tower requires no guying and withstands winds to 100 mph (160 km/h). A special hinged base allows complete assembly at ground level and permits easy raising and lowering. Includes stainless steel hardware. WARC kits to be available.

Other Hy-Gain vertical multiband antennas are available though not shown here. The 12AVQS (20, 15, 10 meter) is similar to 18AVT above but with VSWR of 1.5:1 or less on all bands. The 18VS (80-10 meter) comes with a base loading coil and may be installed on a short mast driven into the ground. All include stainless steel hardware.

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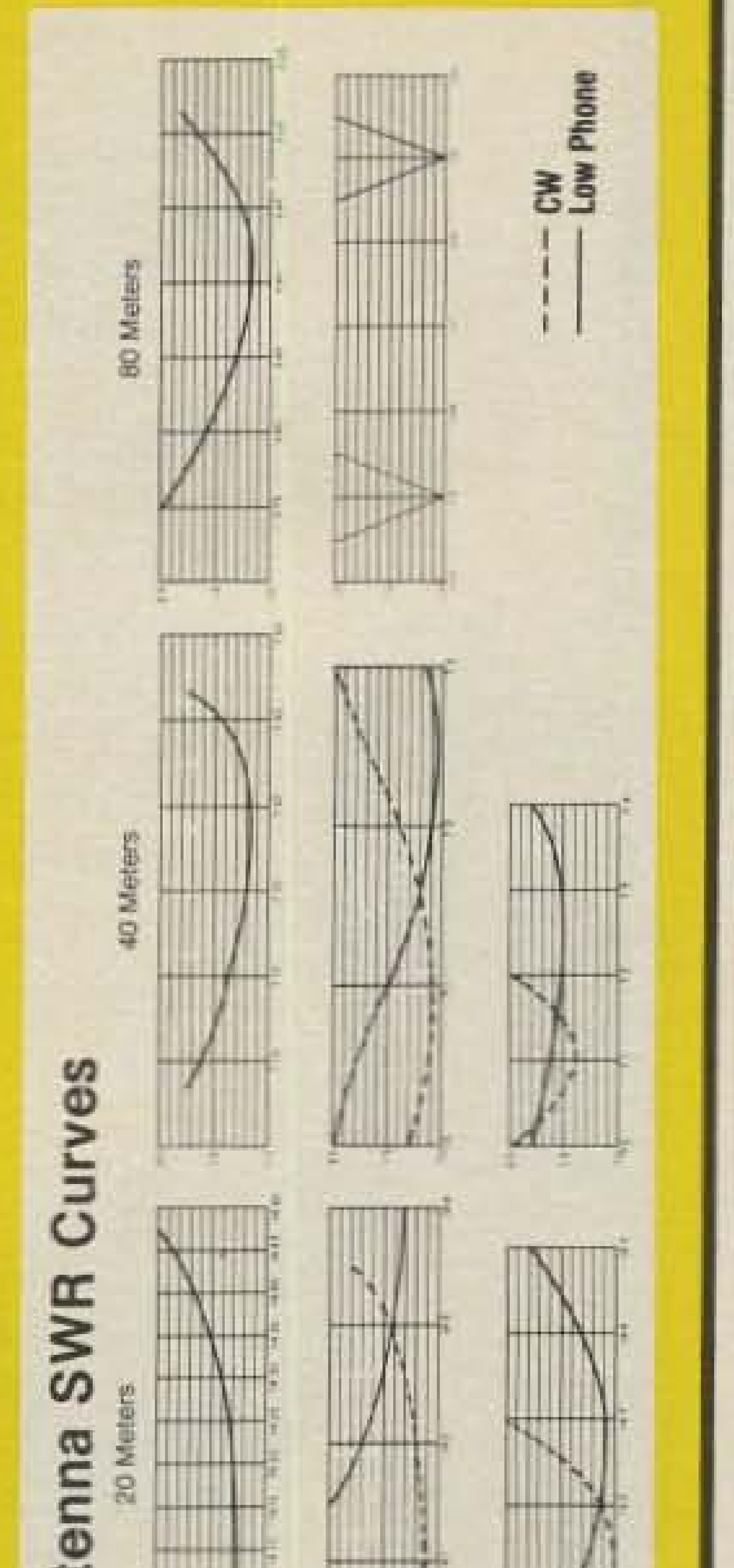

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SANTEC LS-202A SINGLE-SIDEBAND & FM 2-METER HANDHELD TRANSCEIVER

Single-sideband really works in nonrepeater situations and has over 5 times the battery life per battery charge according to the engineers who developed the LS-202A. The slide-on, locking battery pack can contain either Ni-Cd 'AA' cells or 'AA' alkaline-type batteries, or a special higher voltage Ni-Cd pack can be purchased as an option. The special VXO and RIT circuits add flexibility to the 5 kHz step synthesizer to provide continuous tuning for Upper or Lower SSB. High (2.5 W PEP) or Low (0.5 W PEP) is selectable by a switch. Lighted receive 'S-Meter' with Transmit battery level display and thumb-wheel switch lighting make using the LS-202A more comfortable.

FM mode is still the FUN MODE to many people, and the LS-202A works all the repeater frequencies from 144 to 148 MHz with the normal ± 600 kHz offset. Good, crisp audio comes from the internal mic, and there is the capability of using an external speaker mic of the popular variety.

Santec and SSB simply just got better. See one today at your Santec dealer.

SANTEC®

Technical Talk

SPECIFICATIONS	SSB/FM
Freq. Range	144.000–147.995 MHz
Synthesizer	5 kHz Steps + VXO
Modes	USB (A3J), LSB (A3J), FM
Voltage Range	6–12 VDC
Current Drain	30 mA RX Standby 750 mA TX Peak
Power Output	2.5 W PEP (9 V) 3.5 W PEP (10.8 V)
Receiver Bandwidth	2.4 kHz (– 6 dB) SSB 15 kHz (– 6 dB) FM
Sensitivity	0.25 uV (12 dB S/N) SINAD
IF Frequencies	10.695 MHz SSB, 10.695 MHz and 0.455 MHz FM
Spurious	– 60 dB

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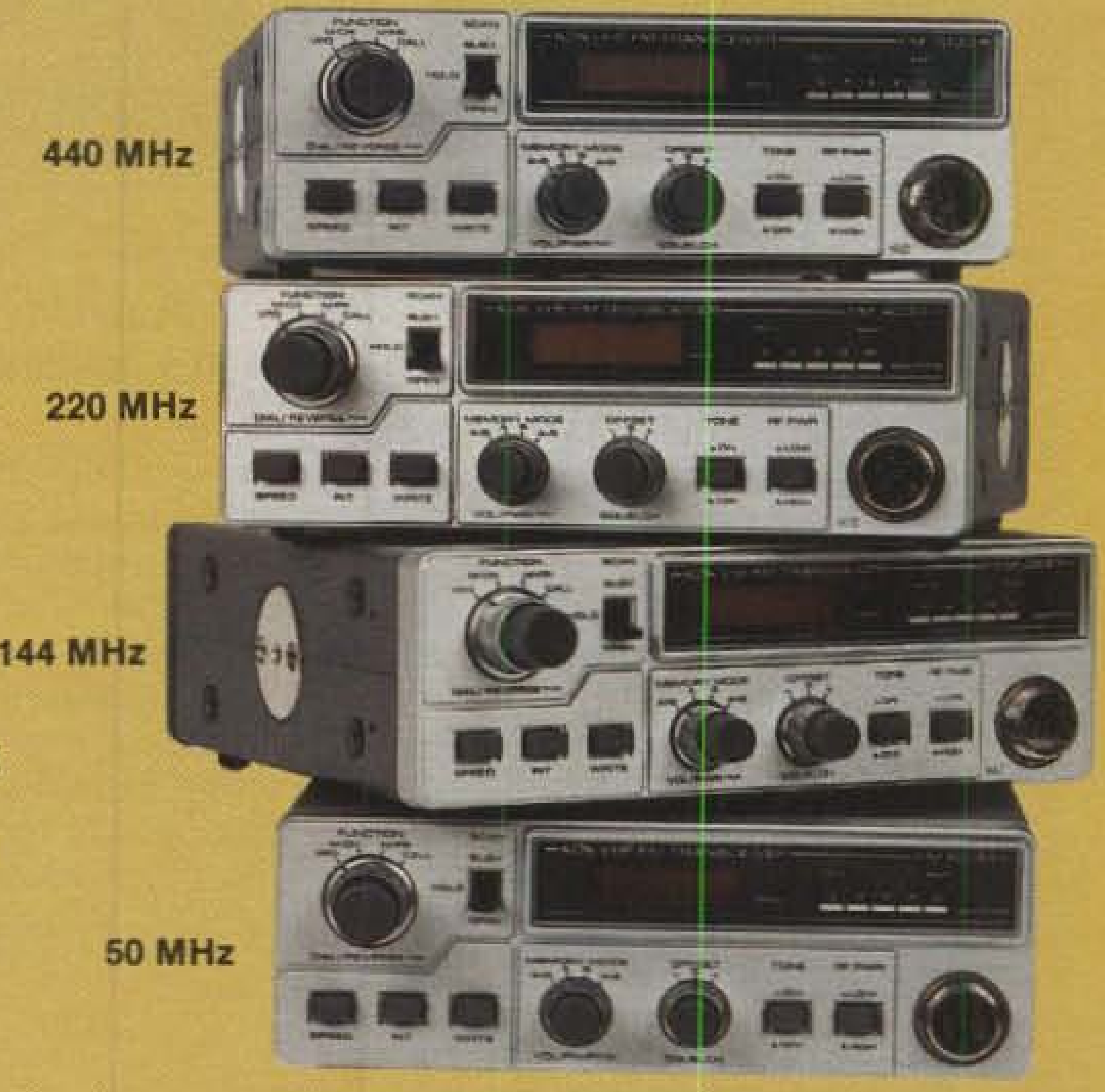

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Our Readers Say:

Amateur Radio Exhibition At Louisiana World Exposition

Editor, *CQ:*

The Louisiana Amateur Radio Exhibit at the World Exposition in New Orleans will be open until November 11. The station, K5WF, is on the air daily. There is also a visual exhibit of amateur radio. We have enclosed a photograph of the exhibit area for your use. We welcome visitors to the Exposition, which expects to have had over 11 million visitors by the time it closes in November. We appreciate any publicity you can give us.

Philip P. Spencer, W5LDH
Secretary, L.A.R.E., Inc.
New Orleans, LA

For The Sake Of Ham Radio

Editor, *CQ:*

After a long overdue period of time I finally obtained by ham license. When I passed my last two DOC exams on the 18 April 1984, it was one of the proudest moments of my life to date! That Saturday I purchased a Yaesu FT-207R from Walther, VE6AOJ, and immediately strapped it on even though I had not been issued my call sign yet. I just did not transmit.

Anyway, when I strapped my HT to my side I felt like a new and different person and experienced new feelings from the general public on my way home. One such feeling was segration because to them I was wearing a weird and foreign gadget that blipped, beeped, and made strange sounds whenever the main squelch kicked in. It appears many of the people had never seen a 2 meter rig in action—let alone hear one. Young ladies attracted to my looks were turned off by my HT (oh well, sacrifices must be made for the sake of ham radio, Hi!), bus drivers were irritated by the HT's sounds, and my friends back at the university dorm shied away from me until I reassured them I was not using my HT for a communist plot or to call in artillery strikes.

Basically, what I am trying to say is that it was certainly a change when the HT was on my person, but I do enjoy the mystique given to me by my ham license.

Ham radio has also had a very pronounced effect on my life. The hobby has persuaded me to pursue a degree in electrical engineering at the University of Alberta. I am also a civilian instructor for an army cadet corps, where I presently teach CAF voice procedure and radio fundamentals, and hopefully next year's training schedule will be expanded to include ham radio. Finally, I am trying to enlist in the Canadian Armed Forces' ROTP program to finish off my university degree and specialize as a communications engineer. So as one can see, ham radio has had a very pronounced and beneficial effect on my career choice and life.

With these kinds of beneficial effects, hopefully more people will choose to pursue this hobby and be licensed. With nothing else to say, we'll sign. Hope to see you on the air soon!

Gerald Shand
Swan Hills, Alberta, Canada

A New RTTY Program

Editor, *CQ:*

I have developed a new RTTY program for the Vic-20 with 8K or greater expansion RAM. The program runs ASCII and Baudot at the standard speeds with type ahead, split-screen, and other features. The program is in machine language and is a public domain program that can be downloaded from the Compuserve VIC SIG (date base 8, telecommunications). This letter is to let your readers know that the free program is in Compuserve together with a "doc" file containing the instructions.

Malcolm Mallette, WA9BVS
7272 N. Pennsylvania St.
Indianapolis, IN 46240

An Enlightening Interview

Editor, *CQ:*

I just finished going through the March 1984 issue, and I must compliment you on the fine articles. The interview with Mr. Kowalski by Ted Cohen, N4XX, was most enlightening, and I enjoy reading your monthly articles.

CQ is my choice of magazines to find out about new equipment, but imagine my surprise when I looked for a reader service card so I could send it in and there wasn't any! *(That does happen in the binding process every once in a while.—ed.)* Oh well, that won't stop me from buying your magazine. Thanks for a great magazine, and keep up the good work.

Phil Spratt, KA9LJK
Eau Claire, WI

Amateur Licensing

This column lists the current requirements for obtaining the various Federal Communications Commission (FCC) amateur radio operator licenses. For the absolute latest information, please contact the nearest FCC office or else telephone Dick Bash, KL7IHP at (415) 278-8275.

NOVICE CLASS This is the typical beginning license. The applicant must pass a 5 word per minute (w.p.m.) International Morse Code test and then pass a 20 question written test on basic theory and rules from a properly licensed examiner. The examiner must be an amateur radio operator who holds a General, Advanced, or Extra Class license and meets the requirements specified in 97.31 of the FCC Rules. The examiner will grade the exam on the spot and, if the applicant passes, will complete and forward the applicant's FCC Form 610 to the FCC in Gettysburg, PA. The FCC will then mail the applicant his/her Novice license in about a month. The Novice licensee can only transmit in Morse code on the designated HF Novice Class bands. Legal details are in 97.27 through 97.33 of the FCC's Rules & Regulations. Anyone interested in the Novice Class or in examining a Novice applicant should read these rules.

TECHNICIAN CLASS This license gives the holder Novice Class privileges on the HF bands and full amateur privileges above 30 megahertz (MHz). The exam for the Technician consists of a 70 question written test and a 5 w.p.m. code test unless the applicant has already passed a Novice exam, in which case he/she doesn't have to retake the code test or the 20 Novice Class written questions. The "Tech" license gives you voice, television (fast- or slow-scan), radioteletype (RTTY), and facsimile privileges. It even lets you communicate via the amateur satellites that orbit the Earth!

GENERAL CLASS The General ticket gives you full amateur privileges above 30 MHz (just like the Tech ticket) but also gives you voice, RTTY, slow-scan television (SSTV), and facsimile privileges on the HF bands. You are also given additional frequencies for code. To get a General Class ticket, you must pass a 13 w.p.m. code test and the 70 question written exam mentioned in the previous discussion about the Tech license.

ADVANCED CLASS This license gives you additional HF privileges for voice, etc. If you presently hold a General Class license, you need only to take and pass an additional 50 question written exam.

EXTRA CLASS This is the highest level of license that the FCC currently has for amateur radio operators. This gives you all possible privileges and (if you presently hold an Advanced Class license) requires that you first pass a 20 w.p.m. code test and then pass a 40 question written test. All of the above licenses are valid for 10 years and are renewable.

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Given a cost per unit budget for the CP-1, Al designed as much performance as possible into the Computer Patch, including a unique new tuning indicator, referred to by one of our customers as the "Dead Eye Dick" tuning indicator. This indicator is ideal for RTTY and CW, in that it is both fast to tune and (within 10 Hz) as accurate as scope tuning. It also performs under poor signal to noise conditions in which other indicators provide no useful data.

Al's variable shift tuning was designed to move the space filter center frequency from 2225 Hz to 3125 Hz without changing the bandwidth (by varying the Q of the filter). All this is accomplished using a precision ganged potentiometer to assure proper tracking of the multiple filter stages. We could have used a pot costing a tenth as much by simply using a two-pole filter design, but we feel the advantage of a sharper filter reduces the noise bandwidth significantly and allows the variable shift control to be used like passband tuning for extra elimination of adjacent channel interference.

Some manufacturers are concerned that amateurs might try calibrating their own equipment and, therefore, have used non-adjustable components, which results in sub-optimal performance. Although more costly, trimpots used in AEA equipment allow factory adjustment for performance to design specifications. Competently designed active filter circuits need not be adjusted after leaving the factory; however, for specialized use the owner can easily change filter parameters.

Mindful of the fact that many of our customers are new to RTTY, Al made the CP-1 tuning as forgiving as possible, while providing the most critical operator a piece of equipment in which he could be proud. Even old "pro's" are surprised at the poor signal conditions under which the CP-1 will still provide good copy.

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MAIN MENU SCREEN

```
                    hh:mm:ss
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 A. ASCII
 R. RTTY
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 U. AUTO AMTOR
 X. AUTO CALL
 C. COMMANDS
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- CW receive and transmit at 5 to 99 wpm, auto speed track on receive.
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- Beacon and WRU system, includes QRG check before XMT, won't QRM.
- Message forwarding system, AUTO-AMTOR still functions in this mode.
- Selects command menu.
- Selects options menu.

+ Complete precompose split-screen display with status information.
+ Complete printer control including SELCALL/WRU printer control.

OPTIONS MENU SCREEN

```
                         hh:mm:ss
I. CALLSIGN          ??????
S. SELCALL             ????
T. ARQ TIMEOUT           30
U. USOS                  ON
M. MORSE FILL (BT)      OFF
R. RTTY SYNC (NUL)      OFF
A. AUDIO FEEDBACK       OFF
C. AUTO CR               ON
L. AUTO LF               ON
B. BEACON RECORD        OFF
W. WRAP-AROUND           ON
K. CW BREAK-IN          OFF
O. OUTPUT MODE         WORD
```

- 24-hour clock, shows time in hours, minutes and seconds.
- Allows entry of your callsign for auto operations.
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- Sets ARQ phasing calls from 1 to 99 seconds.
- Unshift on space, toggles on or off.
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- Sends CR/LF if there is a space in the last 5 positions on the line.
- Automatic transmit/receive switching during QSO.
- Transmit in word mode (text sent on space) or character mode.

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+ CW speed lock and Farnsworth low-speed CW.
+ 10 soft-partitioned™ message buffers plus direct from disk or tape.

COMMAND MENU SCREEN

```
                    hh:mm:ss

L. LOAD
E. EDIT
M. MOVE
S. SAVE
X. SET XMT BUFFER SIZE
C. SET COLOR
T. SET TIME
```

- Allows loading of message or QSO buffers from disk or cassette.
- Word processor type edit functions on message and QSO buffers.
- Allows transmission of QSO buffer without disk or cassette systems.
- Allows you to save message and QSO buffers to disk or cassette.
- Set the transmit pre-type buffer to any size you like.
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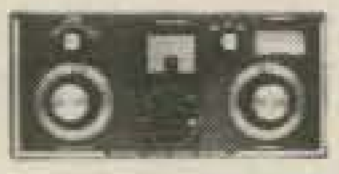

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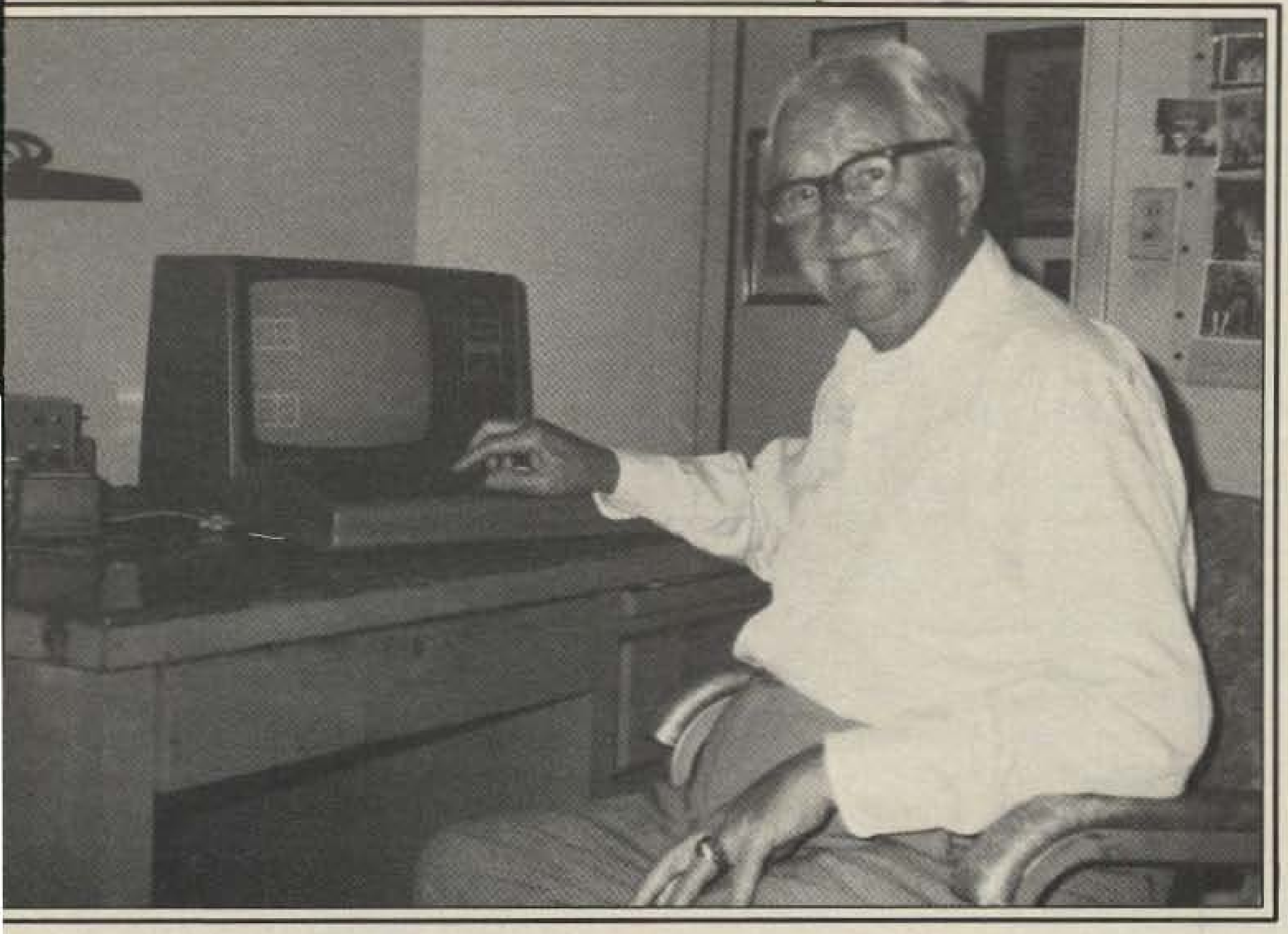

From spark to computers, Bill Halligan's used them all!

> ***"Marconi had a licensed station—WBF—which was located in the Filene Building in Boston, and he talked with various ships sailing out of Boston harbor."***

A CQ Exclusive Interview With:

William J. Halligan, W9AC/W4AK

Founder, Hallicrafters, Inc.

BY THEODORE J. COHEN*, N4XX

William (Bill) J. Halligan, Sr., W9AC/W4AK, was born in Boston, MA, on December 8, 1898, and obtained his first amateur license in 1914. A veteran of WW I, and a former student at Tufts College and West Point (Honorary BSEE, Tufts, 1947), his career spans virtually the entire history of radio communications, from the days of spark to the present. While Bill has had a long and varied career, he is probably best known as the founder of Hallicrafters, Inc., one of the foremost producers of radio transmitters and receivers during and following WW II. The Hallicrafters name was synonymous with high performance, durability, and long life, and more than a few amateurs got their start in radio using receivers such as the S-38, the SX-71, and other fine Hallicrafters products.

Now retired commercially, Bill is still active on the air and spends most of his time in Chicago, IL, and Miami, FL. He is a Fellow of the IEEE and a Life Member of The Radio Club of America, the QCWA, the ARRL, and the Antique Wireless Association. For his "significant contributions to the advancement of electronic communications," Bill was recently awarded the Sarnoff Citation by The Radio Club of America. It is with great pleasure, then, that we present this exclusive interview with one of America's radio pioneers, Mr. Bill Halligan.

CQ: Bill, you received your first ticket in 1914, when you were in high school. What was it about amateur radio that caught your interest?

Halligan: Well, when I lived in Charlestown, which was near the Boston Navy Yard, the Navy was beginning to operate a spark-gap transmitter station, NAD. I could hear their signals on my little crystal receiver, and gradually I began to understand the code. This was all very interesting to me, and since the best way to learn more about what was going on in radio was to get a ham ticket, I proceeded to study the code and pass the necessary tests.

CQ: What did you have to do to get a license in those days?

Halligan: Radio licenses of any kind were first required around 1912. For your ham

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ticket you had to pass the code examination and answer various technical questions.

CQ: What was the nature of the Amateur service at that time?
Halligan: Almost everyone, of course, built his own equipment, including receivers. And on-the-air activities consisted of just conversing with other operators, primarily in code.

CQ: What about the operators in those early days? How would you describe them?
Halligan: Ted, the first operators—around 1914 or so—were younger men who developed a strong feeling of comaraderie. By the way, Marconi had a licensed station—WBF—which belonged to his corporation and which was located in the Filene Building in Boston. Using this station, he often talked with various ships sailing out of Boston harbor.

CQ: What direction did your own amateur activities take in the years 1914–16?
Halligan: I spent most of my time just talking with local operators. In 1916, with a view towards getting a commercial license, I went to Eastern Radio Institute to improve my code and technical knowledge.

CQ: What about the equipment you used in your first station?
Halligan: It was pretty standard for the times, Ted. I used a one inch spark coil in the transmitter and a simple crystal detector. While all the components you needed were available, you did have to scout around for them.

"Marconi needed operators, and I needed money for school, so I went to work for him at the starting salary of $25.00 per month!"

CQ: In 1916 you received your commercial license and went to work for the Marconi Company. Why did you choose to go to sea rather than on to college?
Halligan: I couldn't afford to go to college. But Marconi needed operators, and I needed money for school, so I went to work for him at the starting salary of $25.00 per month!

CQ: What kind of radio equipment and antennas were used aboard the vessels you served on?
Halligan: The ships used Marconi equipment. A carbon detector was used for a receiver, while the transmitter was a half-kilowatt spark job with a rotary gap. As I recall, the ships only had single longwire antennas.

CQ: You also saw duty at sea during WW I. Did you serve as a radioman?
Halligan: Yes. I served as "sparks" aboard a mine layer, the *USS Canonicus*. We saw duty in the North Sea. One of my duties was to compile a newspaper for the officers and crew from material broadcast by NAA.

CQ: What were some of the major advances in radio that resulted from WW I?
Halligan: Advances were made on all fronts! Receiver sensitivity and selectivity improved, and the shift was on to c.w. and the use of higher power.

CQ: After the War you took up engineering at Tufts College. Did you still have time for amateur radio?
Halligan: There was always time for amateur radio. In addition, I frequently took short leaves to work on ships in order to finance myself. I thoroughly enjoyed keeping abreast of what was going on and of the progress being made in radio.

"I wanted to get into some phase of the radio business because of my interest in amateur and commercial radio and my previous radio experience."

CQ: You went back to Boston in the 1920s, where you opened a small store called The Radio Shack on Brattle Street. What made you decide to go into the radio business, Bill?
Halligan: I wanted to get into some phase of the radio business because of my interest in amateur and commercial radio and my previous radio experience. Tobe Deutschmann and I were working together at the time, importing radio parts and equipment. We finally decided we should have a store as well as an office on Cornhill. We therefore leased a store; the name came from a ship's radio room which was known as "the shack." Thus was born "The Radio Shack."

CQ: What kind of products were sold in The Radio Shack, and who were your primary customers?
Halligan: We sold most of the radio-related products advertised in the popular consumer magazines. For the most part, our customers were just people who had become interested in radio, and who had read about building a receiver or purchasing a completed unit.

CQ: What was your main area of interest during the 1920s?
Halligan: I spent quite a bit of time designing transmitters. One of my designs was later incorporated in the HT4, a transmitter that was used most successfully in

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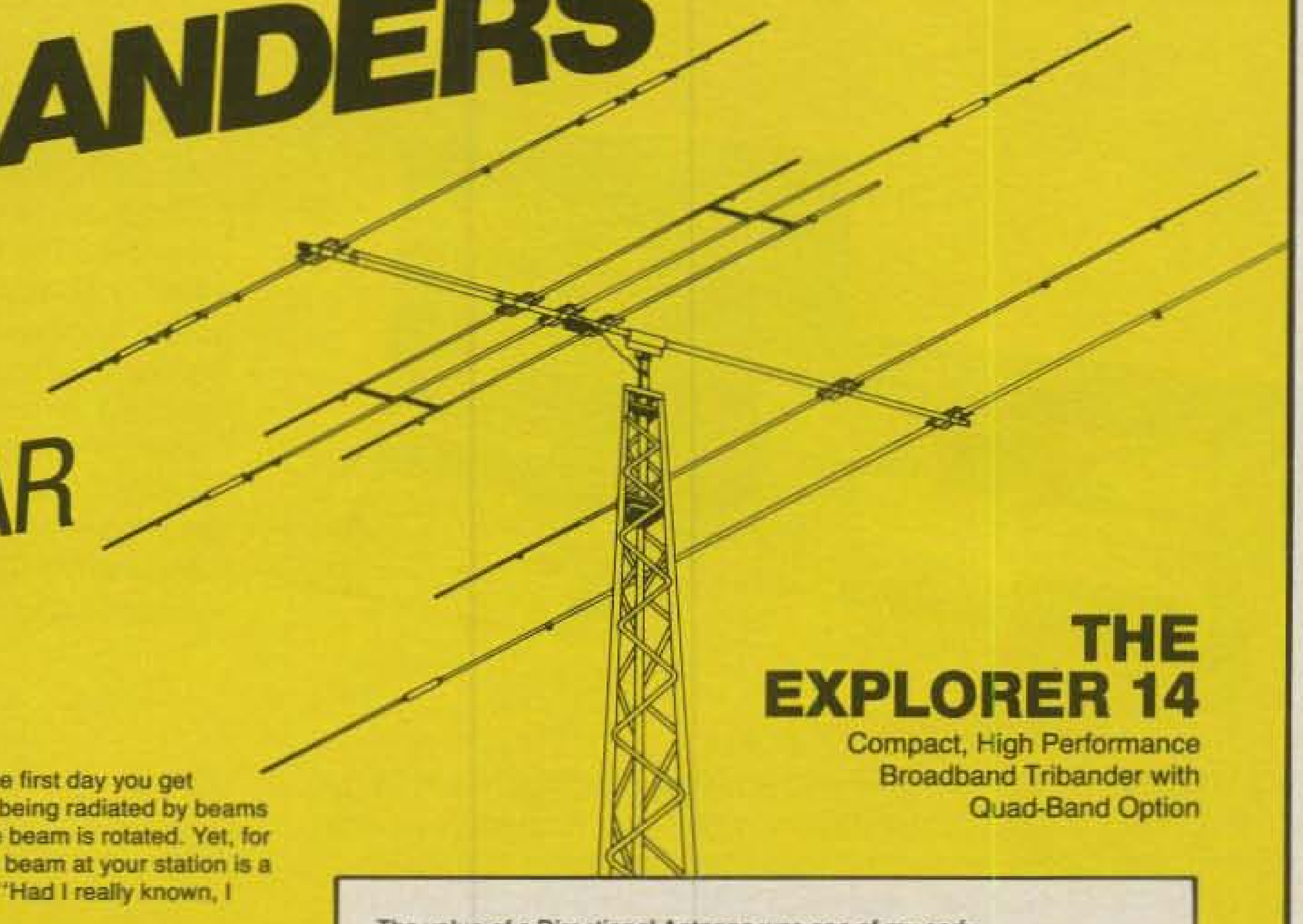

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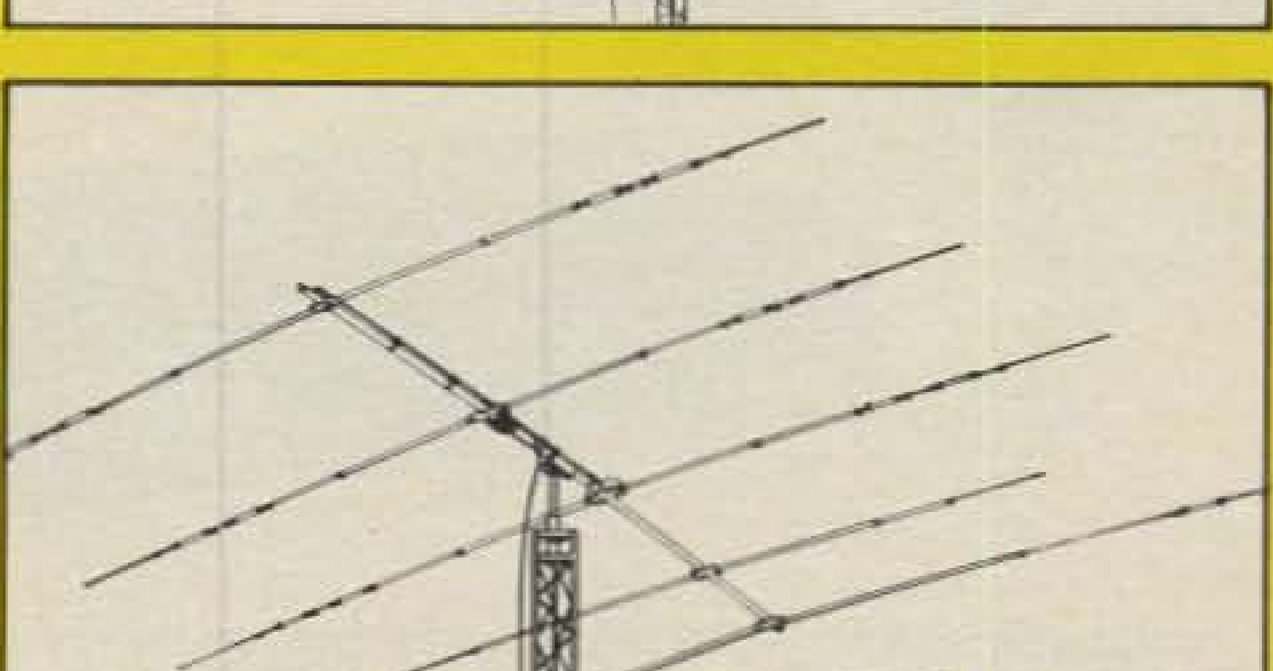
Congratulations!

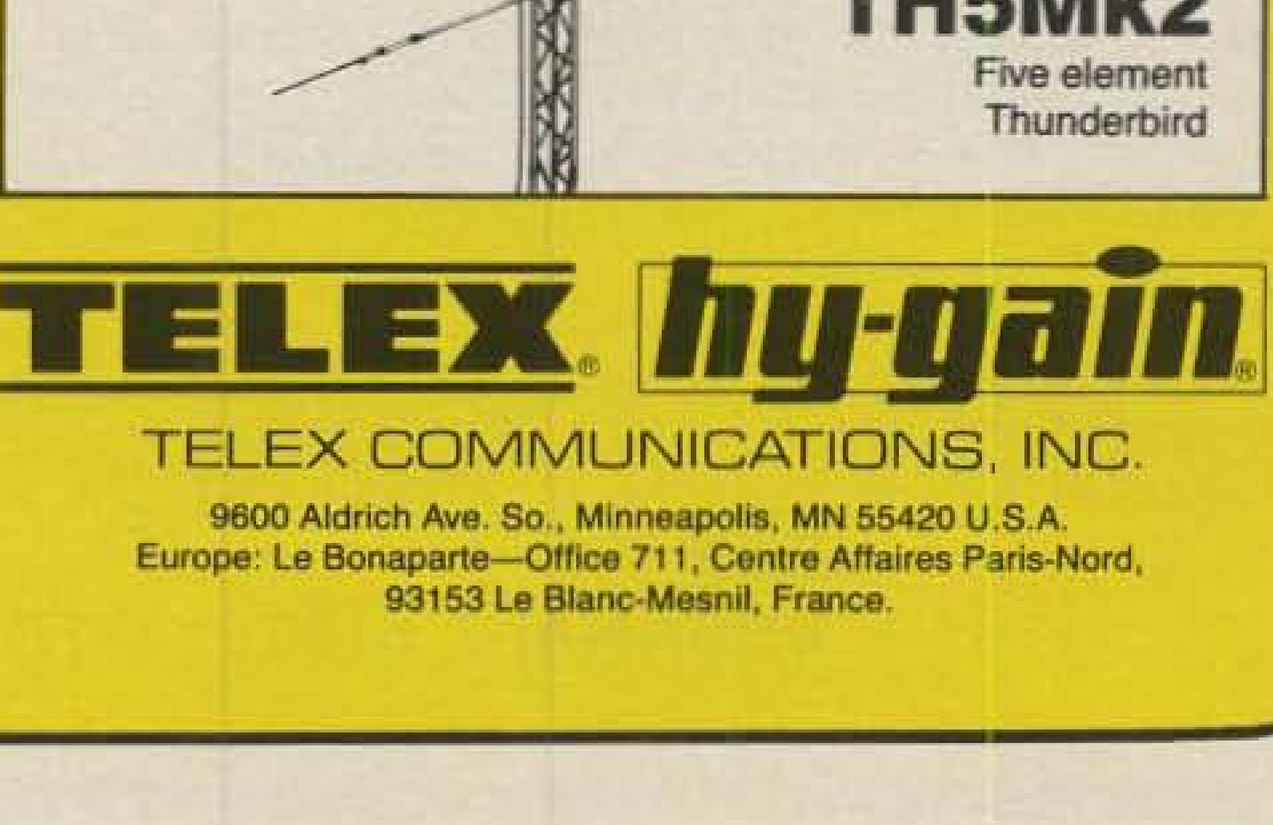
Jack Falker
W8KR

(W8KR has worked all countries but two!)

TH7DX

Seven element
Thunderbird





TH5Mk2

Five element
Thunderbird

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WW II and that figured largely in the D-Day Invasion.

CQ: You eventually left Boston and moved to Chicago. Why?
Halligan: I was very interested in electrifying radio sets. I received several good offers from people in Chicago, and so I left to take advantage of the opportunities presented to me. In Chicago I went into partnership with Larry Chambers. Chambers and Halligan, as we called ourselves, were manufacturers' representatives. We handled Potter condensers, which were made in North Chicago and which were much in demand by those electrifying radio sets. Eventually, Larry and I split up because there was not enough business volume generated by both of us. I subsequently went out on my own, and Hallicrafters was born. I started manufacturing electrified receivers and transmitters, and financed myself on what I had been able to save through the years.

CQ: Describe, if you will, Hallicrafters' first plant.
Halligan: The first plant was very small and was located on Indiana Avenue in Chicago. There were only 12 stations on the assembly line, and our first products were h.f. transmitters and receivers.

> ***"My amateur station was purchased by the FBI and moved to Hawaii. It was from that station, according to J. Edgar Hoover, that the world learned about the bombing of Pearl Harbor on December 7, 1941."***

CQ: Was the company formed primarily to provide equipment to the military?
Halligan: Yes, we were primarily interested in the military market, but we also wanted to sell to hams. Even the FBI bought some of their equipment from us. I remember that during the period just prior to Pearl Harbor, I was contacted by the Chicago representative of the FBI—on behalf of J. Edgar Hoover—regarding the purchase of a complete radio station. I sold them my own station because it was complete and functioning well. This station was moved by the Bureau to a secret location in Hawaii, I later learned, and it was from that location and on that station, according to J. Edgar Hoover, that the world learned about the bombing of Pearl Harbor on December 7, 1941.

CQ: Was it profitable to build equipment for amateurs in those days?
Halligan: No, not particularly, Ted. You had to "push," and eventually it paid off in sales.

CQ: Who was your competition in the early days?
Halligan: Oh, National Company, Hammarlund, and a few others. Interestingly, our competition came from American companies.

CQ: While building Hallicrafters into a major producer of communication products, did you still find time to get on the air?
Halligan: Yes! I enjoyed working both voice and c.w., mostly on 20 meters!

CQ: Bill, besides radio equipment, Hallicrafters built a fine line of commercial television receivers. When did you begin to produce TV sets, and what led you to abandon the line?
Halligan: We started building television receivers shortly after WW II, but abandoned the line in the '50s because of high competition, price cutting, and so forth. We felt we could do better as a company by sticking to the production of radio equipment for the military.

CQ: Why did Hallicrafters cease production of amateur equipment in the mid-1970s?
Halligan: Again, we felt that our interests were best served by producing equipment for the military. To compete successfully in the amateur marketplace at that time would simply have taken too much time and effort.

CQ: What made you decide to sell Hallicrafters to Northrop?
Halligan: A number of large companies had approached me to buy the corporation. Since I was reaching an age when retirement was a consideration, I decided to sell to Northrop.

CQ: Is equipment still being made under the Hallicrafters label?
Halligan: None that I know of, Ted. Several unauthorized people tried to use the Hallicrafters name at one point, but these activities were stopped.

> ***"I'm most proud of the part Hallicrafters played in the military, and particularly of the importance of our transmitters and receivers in WW II."***

CQ: Of all the things you've done in life, Bill, of what are you the proudest?
Halligan: I would have to say that I'm most proud of the part Hallicrafters played in the military, and particularly of the importance of our transmitters and receivers in WW II.

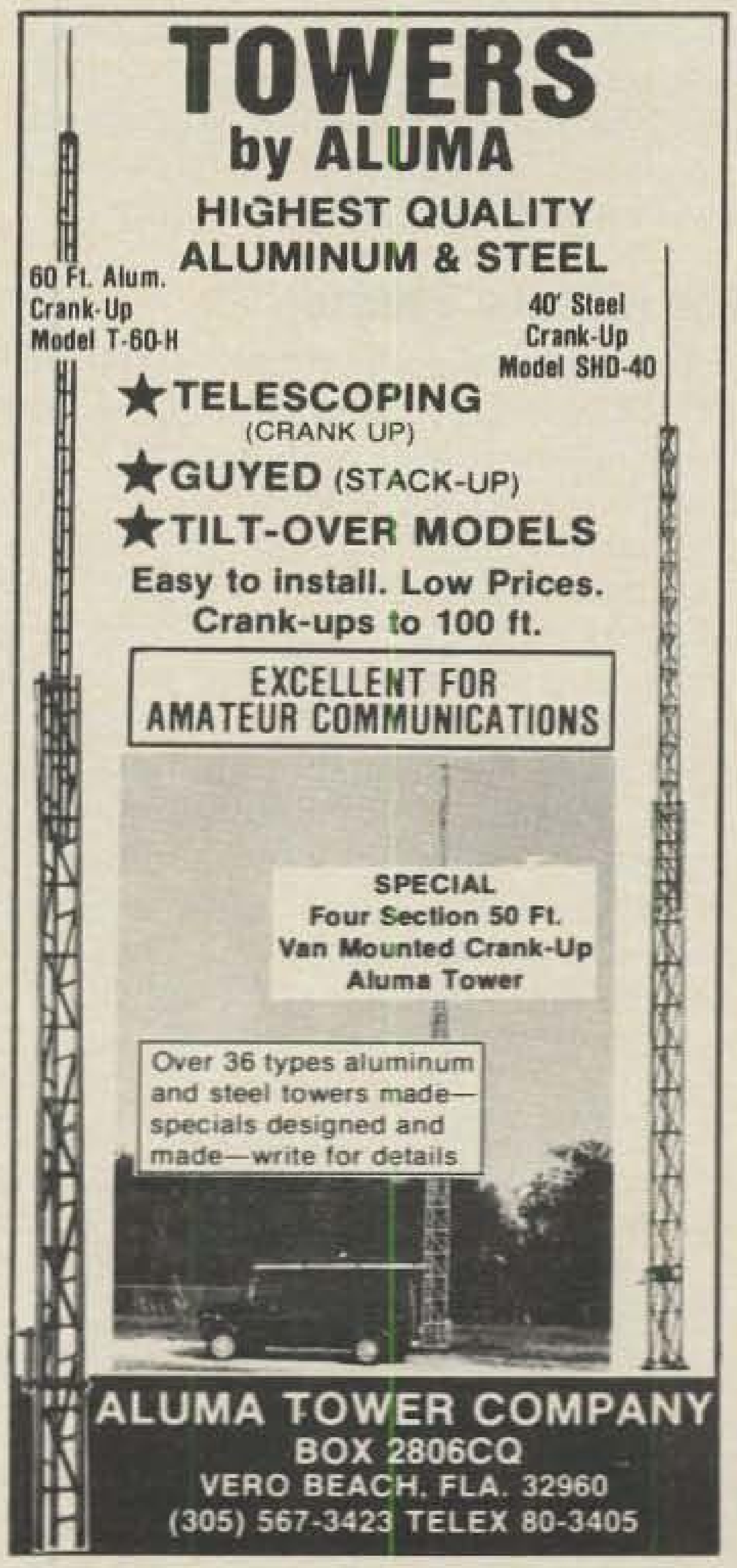
CQ: What would you say to a young man or woman who was considering a career in communications/electronics?
Halligan: I'd encourage them to consider a career in this field. The opportunities are boundless! I'd also tell them to get as broad a background in electronic technology as is possible. A little course work in business administration would also be helpful today.

CQ: Are you still active on the air?
Halligan: Oh, yes, on the 20 meter band. The transmitter and receiver may not be the most modern equipment available, but it still does the job.

CQ: Technology aside, how would you characterize the Amateur service today?
Halligan: As in the past, there still exists a close bond among operators, and I find that in general, they still hold each other in high regard. Of course, today it is much easier to communicate with amateurs all over the world, and as such, the potential to render service in times of disasters and catastrophes is much greater.

CQ: What impresses you most about the Amateur service today?
Halligan: I guess I'd have to say the way it improves communications among people, and how it brings us closer together in this strife-torn world we live in today.

CQ: Bill, thank you for taking time to be with us.
Halligan: It's been a pleasure!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K2SE has come up with another interesting solution to an operating problem. As usual, it makes for a good construction project.

An Automatic Antenna Selector For The Kenwood TS-430S

BY ED SOLOV*, K2SE

When I began to use my new Kenwood TS-430S, I thought about how nice it would be to not have to think about which antenna was in use when I could so neatly and conveniently change bands on the rig without retuning. It turned out to be relatively simple to set up such a situation, since Kenwood has thoughtfully provided digital information on an auxiliary connector on the 430's rear panel which can be used for this purpose. In this article I will describe how I built this simple automatic antenna selector for my 430S, how I use it at my QTH, how to customize the design for your own antenna farm, and how to do the same for other rigs.

The Antenna Selector

The device described here can be built for $20 to $30, depending upon how many antennas you want to control and how you physically arrange the circuitry and switches. For instance, my selector was built in two pieces: a control unit which is near the rig, and a relay unit which is on the other side of the shack near the antenna feedline entry. The two units, each requiring its own metal box, are connected with a cable. You may find it more convenient and less expensive to house the whole thing in a single enclosure, doing away with one of the boxes and the cable. More about that later.

A block diagram of this selector is shown in fig. 1. The control unit interfaces with the TS-430S via the rig's **ACC** jack on the rear panel using a spare connector plug supplied with the rig. At this jack are a number of signals, including the four digital "discretes" which tell the control unit what frequency range is in use by the rig. The control unit, which contains a little bit of logic to be discussed later, then looks at these four signals and decides which antenna to use. It conveys this information to the relay unit, in which one of a set of relays in energized, depending on the control unit's selection, connecting one—and only one—antenna to the rig. All other relays are de-energized, grounding their antennas. If power is off or if power is on but the rig is off, all antennas are grounded, and the rig is disconnected from the antenna system for a measure of lightning protection.

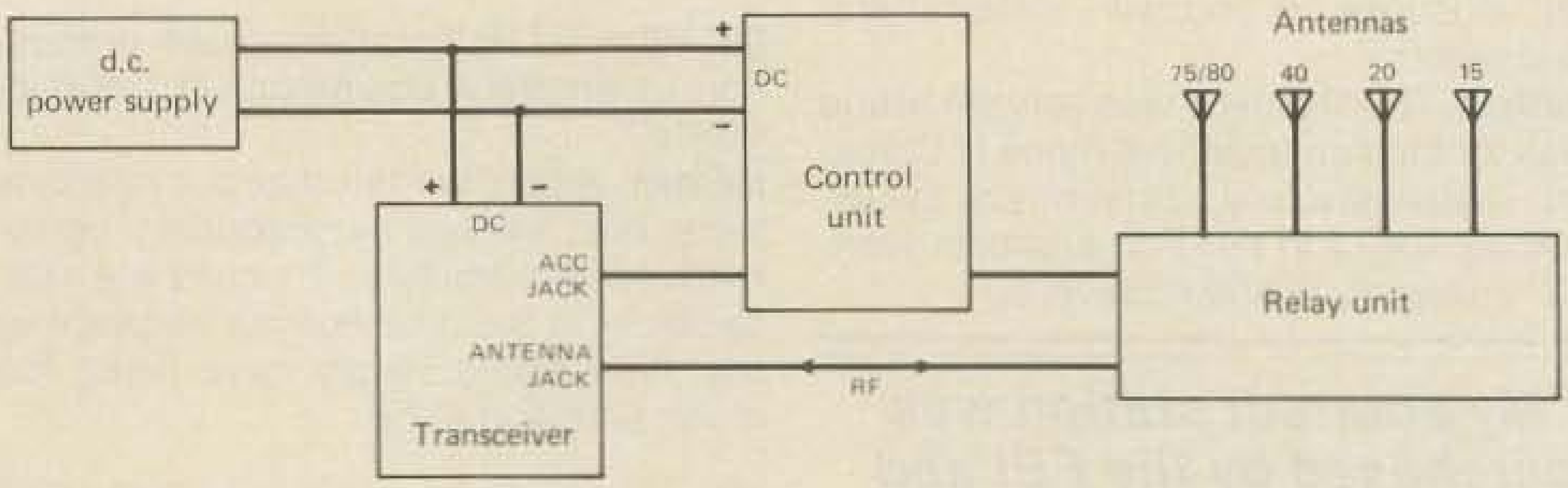


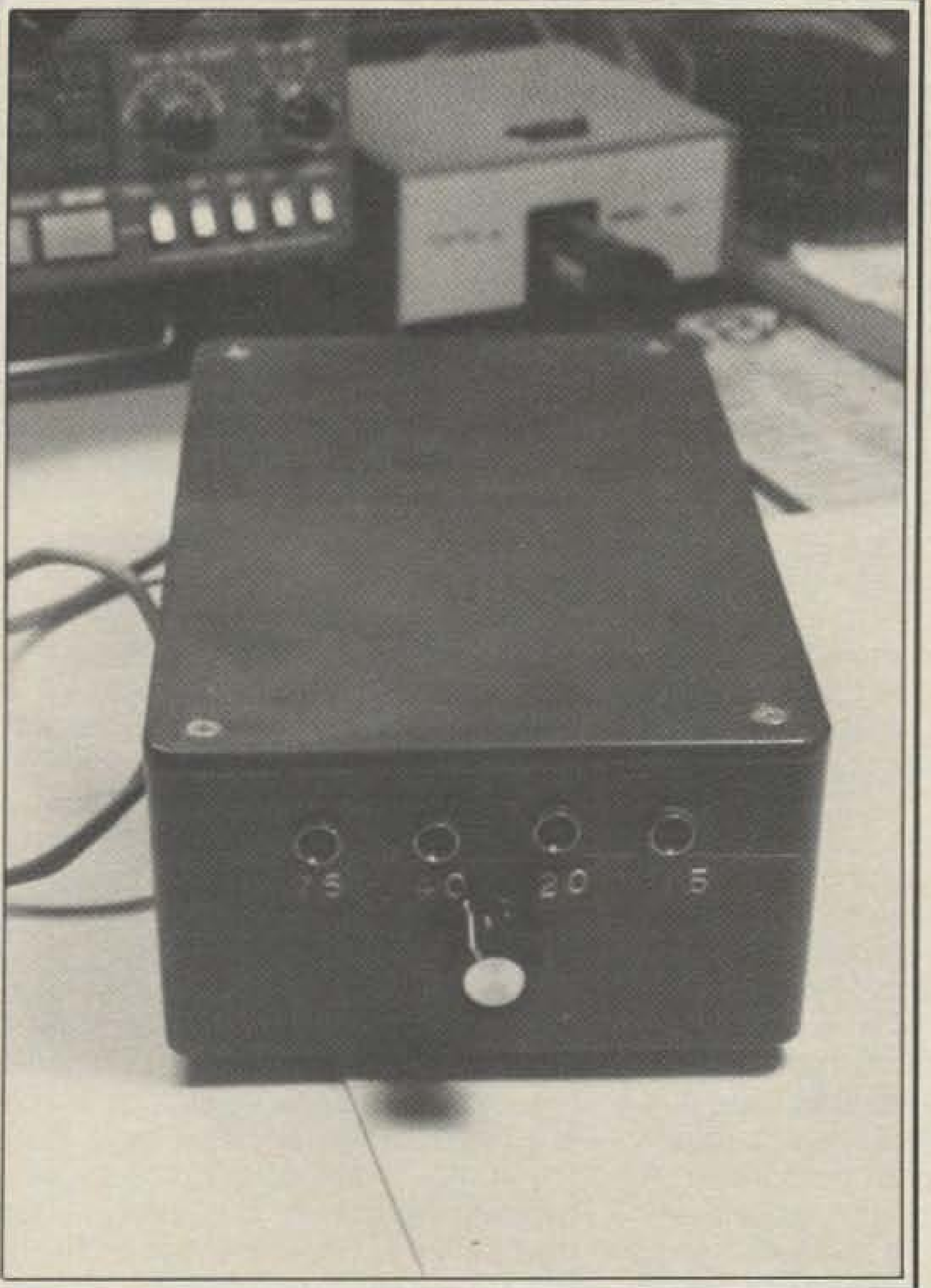
Fig. 1– Block diagram of the K2SE antenna selector system.

Freq. (MHz)	pin 7 BA	pin 1 BB	pin 4 BC	pin 2 BD	High Line*	Antenna Selected K2SE QTH	Antenna Selected Example 1†	Antenna Selected Example 2**
0.15–0.50	low	low	low	low	a	75/80 dipole	75/80 dipole	160 end fed
0.50–1.6	high	low	low	low	b			
1.6–2.5	low	high	low	low	c			
2.5–4.0	high	high	low	low	d			75/80 dipole
4.0–6.5	low	low	high	low	e			
6.5–7.5	high	low	high	low	f	40 dipole	40 dipole	vertical
7.5–10.5	low	high	high	low	g			
10.5–16	high	high	high	low	h	20 dipole	beam	
16–23	low	low	low	high	i	15 dipole		
23–30	high	low	low	high	j	75/80 dipole		

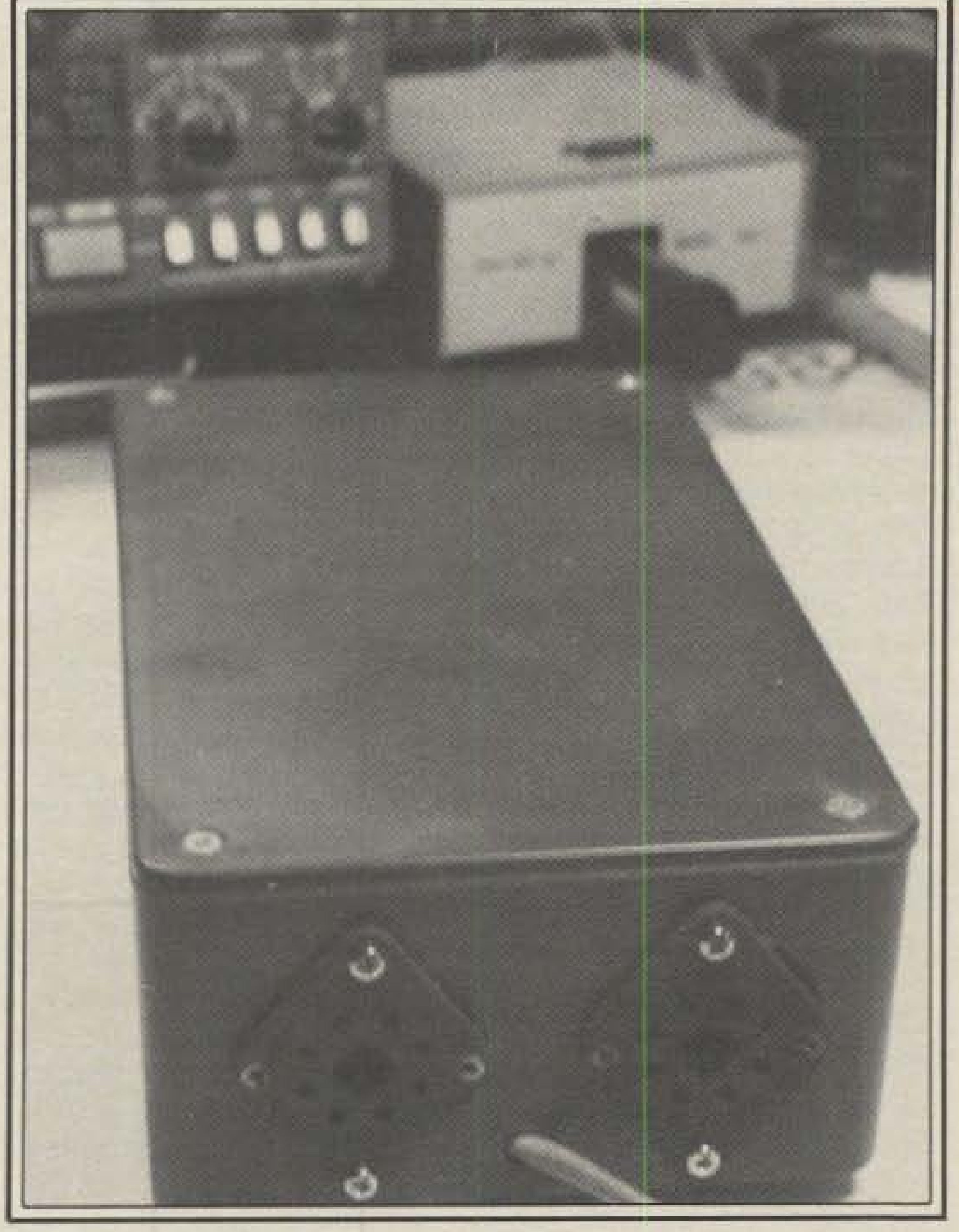
**Lines are identified in fig. 2, the control unit schematic.*
†Example 1: The antenna system consists of a dipole for 75/80 meters; a dipole for 40 meters; and a triband beam for 10, 15, and 20 meters.
***Example 2: The antenna system consists of an end-fed for 160 meters; a dipole for 75/80 meters; and a trap vertical for 10, 15, 20, and 40 meters.*

Table I– TS-430S frequency zones, logic conditions, and antenna selection.

**247 Andover Drive, Wayne, NJ 07470*



Control unit, front view, which shows the LED indicators, manual override switch, and rig in the rear.



Control unit, rear view. Shown are the octal sockets and the 12 v.d.c. power cable. The socket to the left connects the control unit to the relay unit. The socket to the right connects the rig to the control unit.

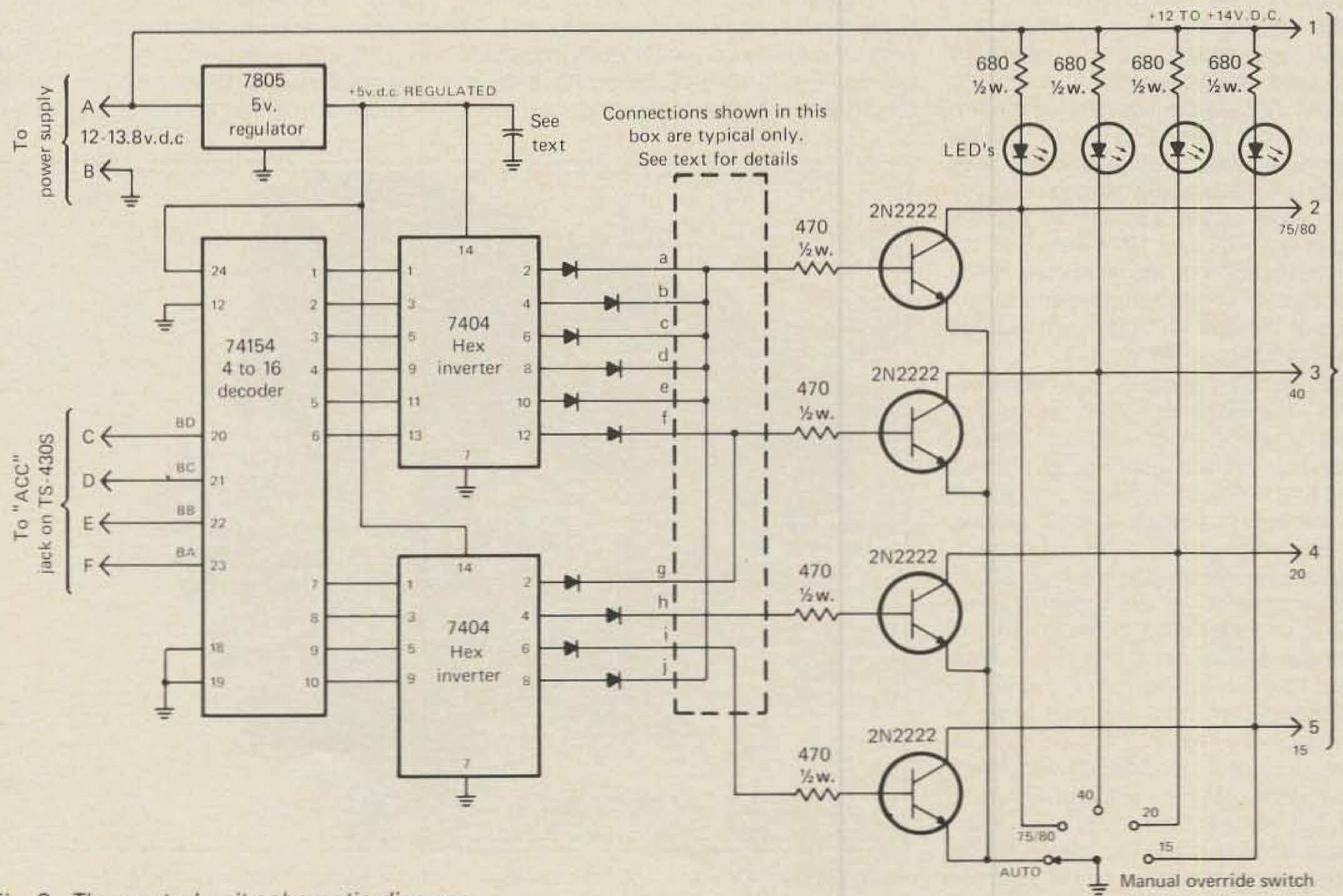

To power supply
A
12-13.8v.d.c
B
7805
5v.
regulator
+5v.d.c. REGULATED
See text
Connections shown in this box are typical only. See text for details
+12 TO +14V.D.C.
1
680 ½w.
680 ½w.
680 ½w.
680 ½w.
LED's
2N2222
2N2222
2N2222
2N2222
470 ½w.
470 ½w.
470 ½w.
470 ½w.
2
75/80
3
40
4
20
5
15
To relay unit
74154
4 to 16
decoder
24
12
20
21
22
23
18
19
1
2
3
4
5
6
7
8
9
10
7404
Hex
inverter
14
7
7404
Hex
inverter
14
7
a
b
c
d
e
f
g
h
i
j
To "ACC" jack on TS-430S
C
D
E
F
BD
BC
BB
BA
75/80
40
20
15
AUTO
Manual override switch

Fig. 2– The control unit schematic diagram.

The "Discretes"

The TS-430S utilizes four of the pins of the **ACC** connector to convey frequency data to the outside world. (These are intended for use by accessories such as Kenwood's AT-250 automatic antenna tuner.) Kenwood calls these signals by the names **BA**, **BB**, **BC**, and **BD**, and they appear on **ACC** pins 7, 1, 4, and 2, respectively. Each of these TTL signals is a d.c. voltage between 3.5 and 5 volts when the signal is logical high and around 0 volts when the signal is a logical low. (All of this info is given in the excellent manual that comes with the rig.) These signals are high and low in differing combinations, depending on the frequency range, as given in Table I (and the Kenwood manual). For instance, if the rig is tuned to 3.695 MHz (or anywhere else between 2.5 and 4.0 MHz), pin 7 (**BA**) will be high, pin 1 (**BB**) will be high, pin 4 (**BC**) will be low, and pin 2 (**BD**) will be low. As the frequency is changed, these signals change level, as shown in Table I.

The Control Unit

The function of the control unit, shown schematically in fig. 2, is to take these four discretes from the rig, and unscramble them so as to output a signal to the relay unit to energize the proper relay. As the four discretes—**BA**, **BB**, **BC**, and **BD**—enter the control unit, they go first to a decoder. In my design I used a 4-line to 16-line decoder, so named because 4 signals, each of which can be either high or low, can take on 16 combinations. The decoder chip operates much like a single-pole, 16-position, digitally operated switch. Each possible combination of the four input signals causes one of the decoder's output lines to go low (all others remain high). Only 10 of the decoder's 16 output lines are actually used in this project, because as you can see in Table I, the rig only generates 10 of the 16 possible combinations of the 4 signals. (You can use a 4-line to 10-line decoder instead, but there is no significant savings or other advantage either way.)

Because of the decoder's perverse operation—the desired output line is low while all others are high—it is convenient to invert all of the used outputs. This means that if an output line is low, the inverter changes it to high, and vice-versa. Thus, we wind up with a set of ten lines, one and only one of which is high at any one time while all of the other nine are low. This is done with a minimum of fuss by using a pair of "hex inverter" chips. Each of these chips actually contains six independent inverters. The pair gives us the capacity to invert 12 logical signals, but we only use 10 of them. These inverted decoder outputs—denoted **a**, **b**, **c**, **d**, **e**, **f**, **g**, **h**, **i**, and **j** in fig. 2 and Table I—are each applied to a diode to allow us to connect them together in any way we choose without fouling up anything.

Why would we want to connect them together? Well, even though the four discretes emanating from the rig delineate ten different frequency ranges, most of us don't have ten different antennas. The same antenna must be used for several of the frequency ranges. For instance, at my QTH there are four antennas (all dipoles). When listening in the general-coverage ranges below 6.5 MHz, for example, or operating in the 75/80 meter bands, I use my 75/80 meter dipole, as shown in Table I. Therefore, whether or not the variables **a**, **b**, **c**, **d**, and **e** are high, I want the relay connecting that antenna to be energized. In the frequency range 6.5 to 10.5 MHz, I use the 40 meter antenna, and so the **f** and **g** lines are connected together, and so on. Since I use the 75/80 meter antenna with a tuner on 10 meters as well, I also connect the **j** line to the 75/80 meter group.

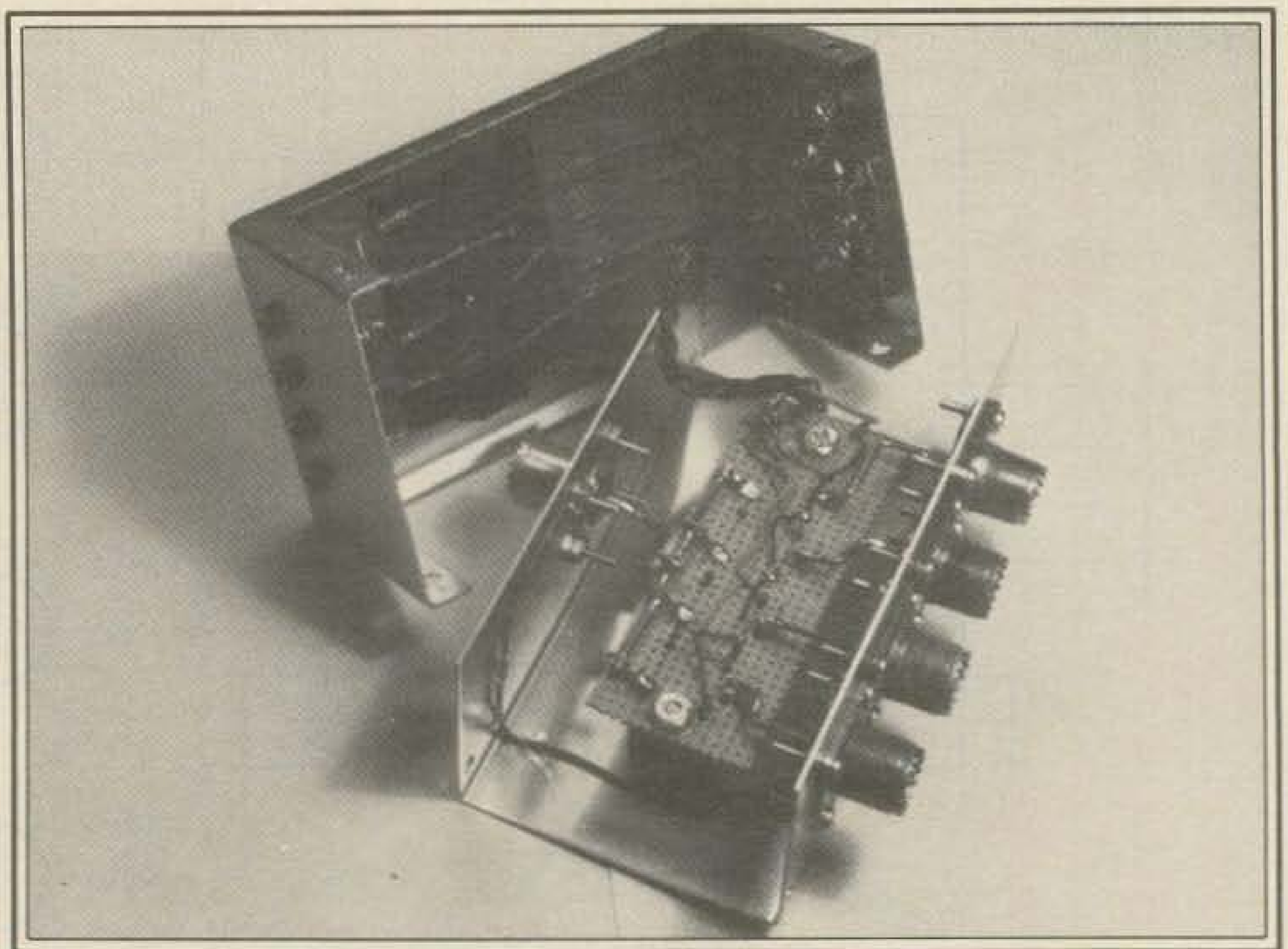
Two other examples of how to program the control unit for a particular set of antennas are given in Table I. In Example 1, where there are three antennas, the diodes of lines **a**, **b**, **c**, **d**, and **e** are tied together, as are those of lines **f** and **g** and those of lines **h**, **i**, and **j**. In Example 2, another case of three antennas, lines **a**, **b**, and **c** go together; lines **d** and **e** go together; and lines **f**, **g**, **h**, **i**, and **j** go together. Finally, if you have a single antenna with loading coil taps, the relays each can be connected to a different tap, depending on frequency. (In that case the relay box should be located very close to the coil being controlled.)

For each antenna to be controlled, there will be one relay in the relay unit. To control each relay, a 2N2222 transistor (or similar) is used. Each of the transistors' bases is tied to a grouped set of control lines through a resistor. A value of 220 to 470 ohms, ¼ or ½ watt will do fine (470 ohms, ½ watt is shown in fig. 2). If you only plan to control three antennas, you'll only need three such combinations. If you plan to control five, you'll need five transistors, and so on.

Each transistor is equipped with an LED indicator to advise you of which line is being selected by the rig and control unit. This, along with its associated 680 ohm resistor, is optional, but I like to know what's going on, so I put them into my design.

I used a rotary switch to allow me to override the decision of the control unit, should the occasion arise. When the switch is in the **Auto** position, the antenna will automatically be selected. If the switch is in any other position, the antenna corresponding to that position will be selected, regardless of what the rig and control unit have decided. You'll need a single-pole switch with a number of positions at least equal to one more than the number of your antennas.

The decoder chip and the two hex inverters that I chose are TTL devices, and they operate from a 5 volt d.c. supply. To provide this, I used a ubiquitous 3-terminal 5 volt 1 amp regulator, type 7805. I found that under certain conditions the regulator appeared to oscillate. I cured the problem brute-force style and without much investigation of the whys or wherefores by hanging a big, fat capacitor (in my case a 220 microFarad, 16 volt job) across the regulator output. You may not need this. I learned that I had the problem when my selector's control unit—without any rig connected—caused gross TVI in the color TV set in the next room! To keep the regulator nice and cool, I used a Ra-



Relay unit, inside view. The r.f. connectors and relays are shown in the bottom section. The top section shows the LED indicators and the octal socket.

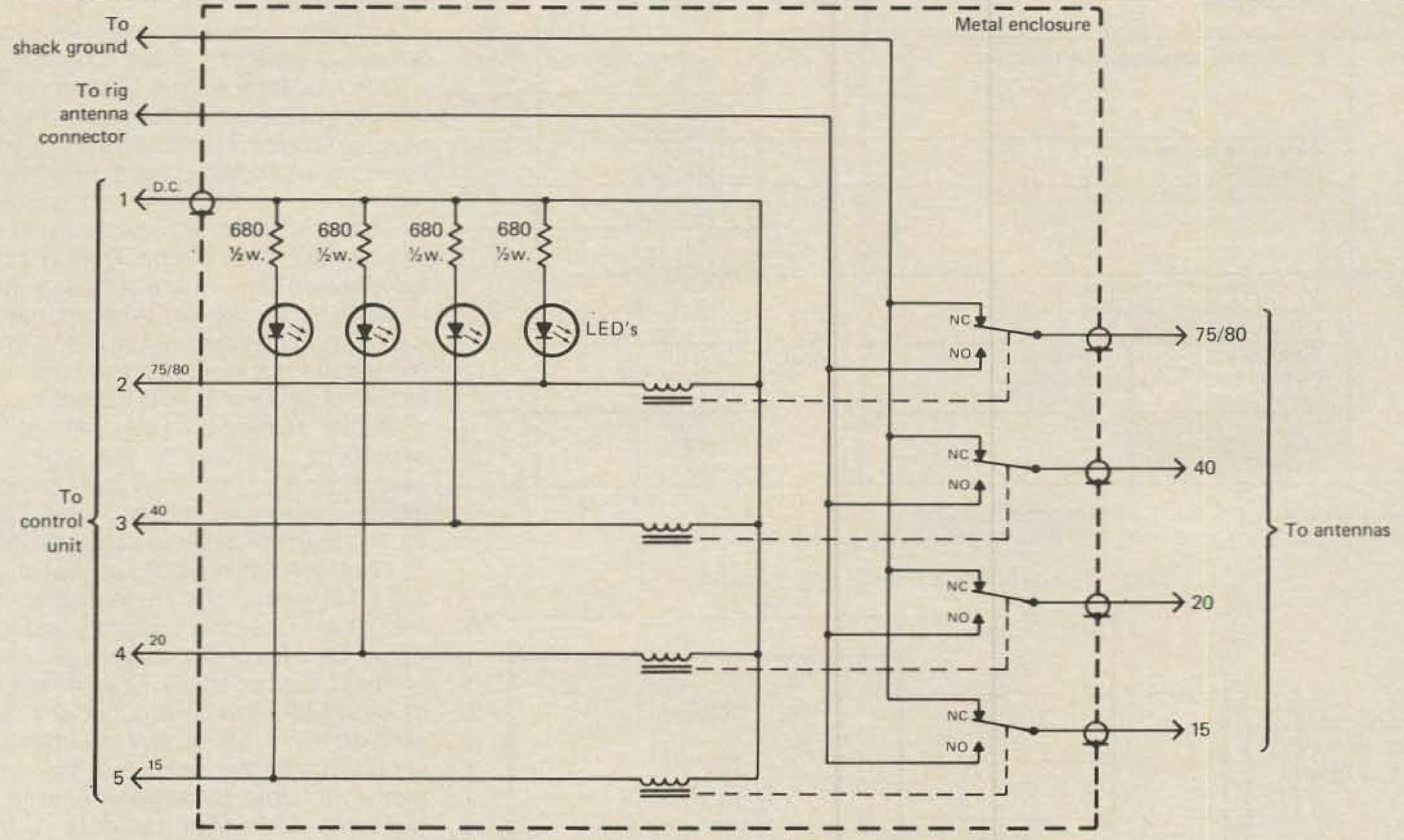

To shack ground
To rig antenna connector
Metal enclosure
1
D.C.
680 ½w.
680 ½w.
680 ½w.
680 ½w.
LED's
2
75/80
3
40
4
20
5
15
To control unit
NC
NO
75/80
40
20
15
To antennas

Fig. 3– Schematic diagram for the relay unit.

dio Shack heat sink on its tab applied with a small nut and bolt and some silicon grease.

The Relay Unit

Whereas the control unit is the brains of the outfit, the relay unit is the muscle. It accepts commands from the control unit and routes the r.f. to and from the rig as ordered. It consists, as shown in fig. 3, of the relays themselves (one for each antenna) and some connectors. In addition, since my relay unit was to be located at the other side of the shack from the control unit, I put another set of LED indicators along with their dropping resistors into it. That way I can glance over my shoulder across the room and make sure that the control unit's message is getting to the relay unit. Again, these are optional, but nice to have.

Power for the relays is taken from the same d.c. source as is that for the control unit. I brought the power over to mine through the same cable (via a spare conductor) that I built for routing the control signals to it.

Construction

The TS-430S **ACC** connector has a ground terminal available on it, but I didn't use this for the circuit ground, because I discovered that bringing the power-supply negative line to the circuit as a ground while also using the **ACC** ground in the circuit caused a ground loop effect which showed up as noise in the receiver. At that point I decided to keep the control circuit ground isolated from the metal boxes I used to house the control and relay units. This is shown in fig. 4. As shown there, the control circuit ground is tied only to the d.c. (–) line and not to its metal enclosure. The metal enclosures are tied together (through the control cable shield) and to the **ACC** connector ground. Also, they are electrically connected to the shells of the r.f. connector on the rig and those on the relay unit. **Although not shown on the schematic, every line, except the r.f. line itself, entering or leaving either box is bypassed** through a disc-ceramic capacitor to the enclosure. Also, each of these lines is shielded, as shown in the grounding diagram of fig. 4 and in greater detail in fig. 5. Maybe all of this is overkill, but I have not introduced any observable noise into the rig, nor has there been any evidence whatsoever of transmitter r.f. getting into the control circuitry.

Most of the parts are available at Radio Shack, with a couple of exceptions. The

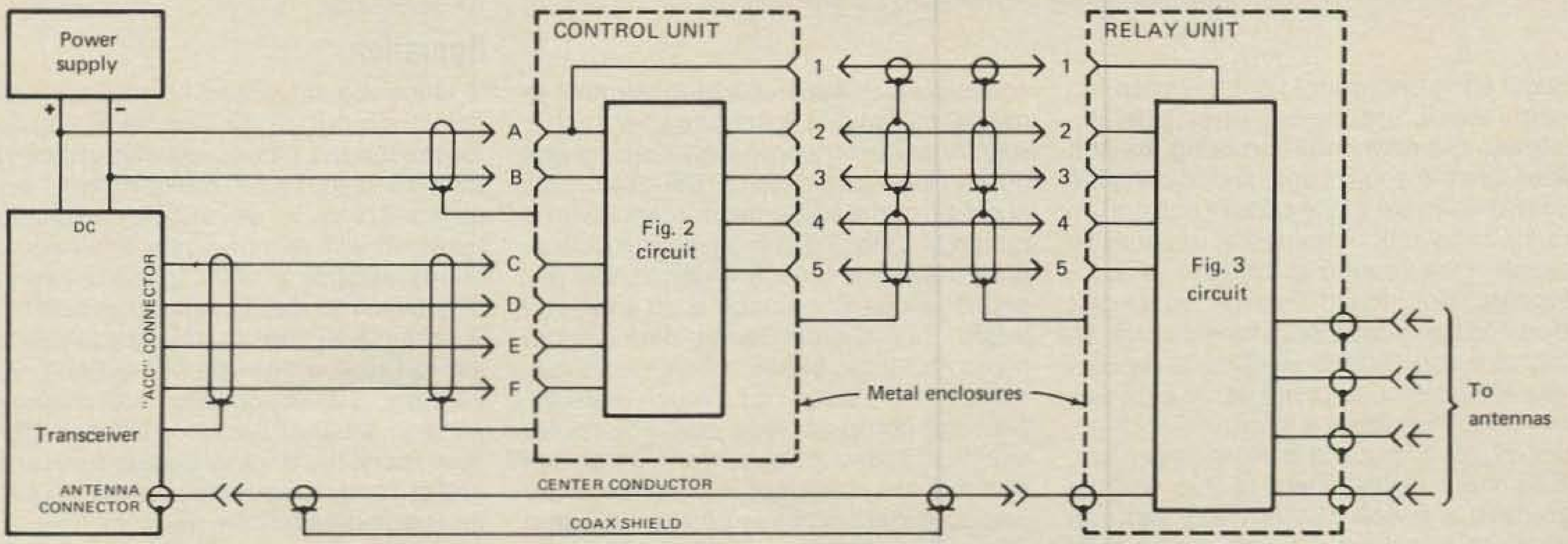

Power supply
+
–
A
B
C
D
E
F
DC
"ACC" CONNECTOR
Transceiver
ANTENNA CONNECTOR
CONTROL UNIT
Fig. 2 circuit
1
2
3
4
5
RELAY UNIT
Fig. 3 circuit
Metal enclosures
CENTER CONDUCTOR
COAX SHIELD
To antennas

Fig. 4– The grounding system schematic.

Unit	Part Description		Quantity	Source	Price Each
Control	5 volt, 1 amp regulator, type 7805		1	Radio Shack #276-1770	$1.59
				Circuit Specialists*	$.80
	4-line to 16-line decoder IC type 74154		1	Circuit Specialists	$1.17
	Hex Inverter IC type 7404		2	Radio Shack #276-1802	$.79
				Circuit Specialists	$.31
Relay	12 volt relay (contact rating depending upon transmitter power). For a 50 ohm antenna load:		1 per antenna or rf.load	Digi-Key† #Z416-ND (7 amp)	$2.70
	Transmitter Output Power (watts)	Minimum Contact Rating (amps)		Digi-Key #Z424-ND (15 amp)	$4.00
	100	1.5		Radio Shack #275-218 (10 amp)	$5.50
	500	3.5			
	1000	10			

**Circuit Specialists, P.O. Box 3047, Scottsdale, AZ 85257.*
†Digi-Key Corp., Highway 32 South, P.O. Box 677, Thief River Falls, MN 56701.

Table II– Major components and sources.

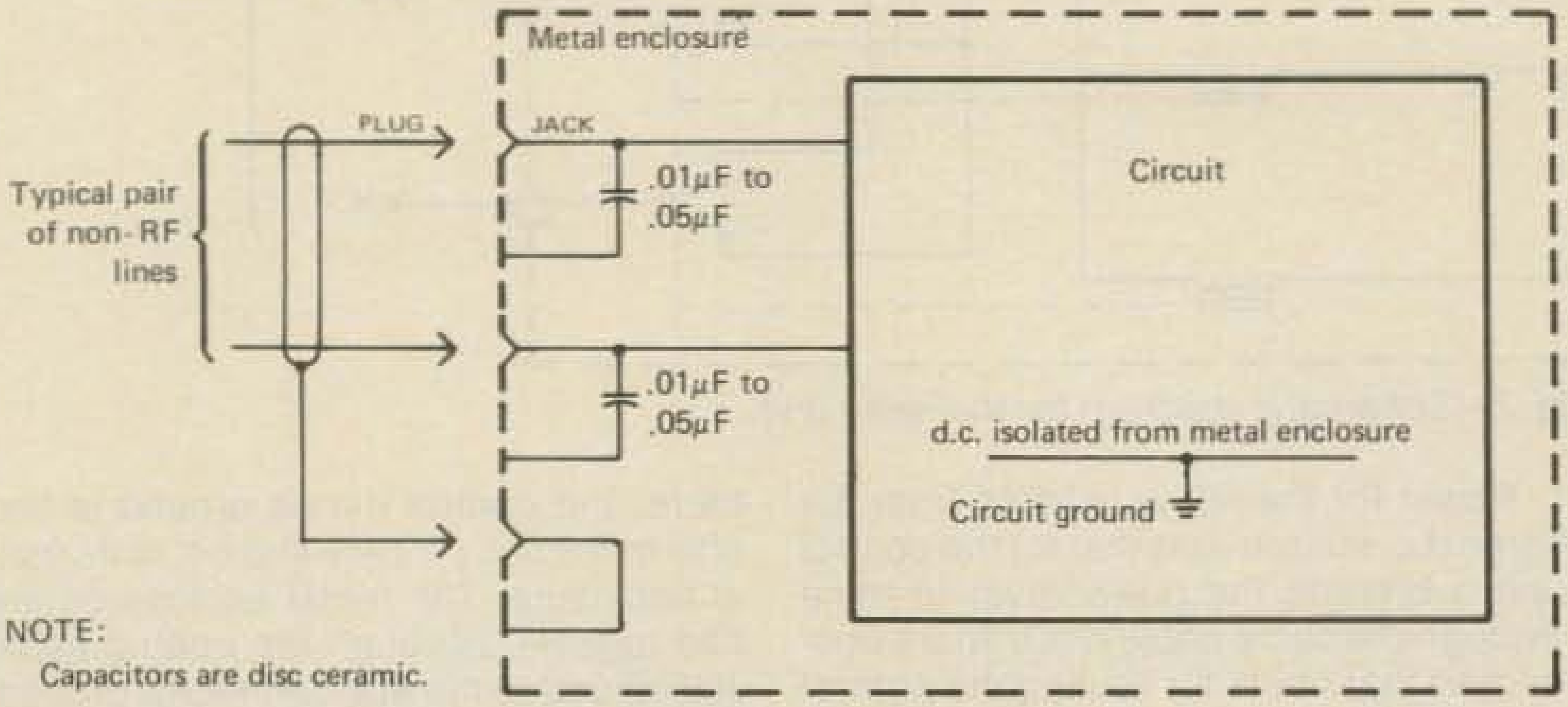

Metal enclosure
PLUG
JACK
Typical pair of non-RF lines
.01µF to .05µF
.01µF to .05µF
Circuit
d.c. isolated from metal enclosure
Circuit ground
NOTE:
Capacitors are disc ceramic.

Fig. 5– Details of bypassing and shield connections.

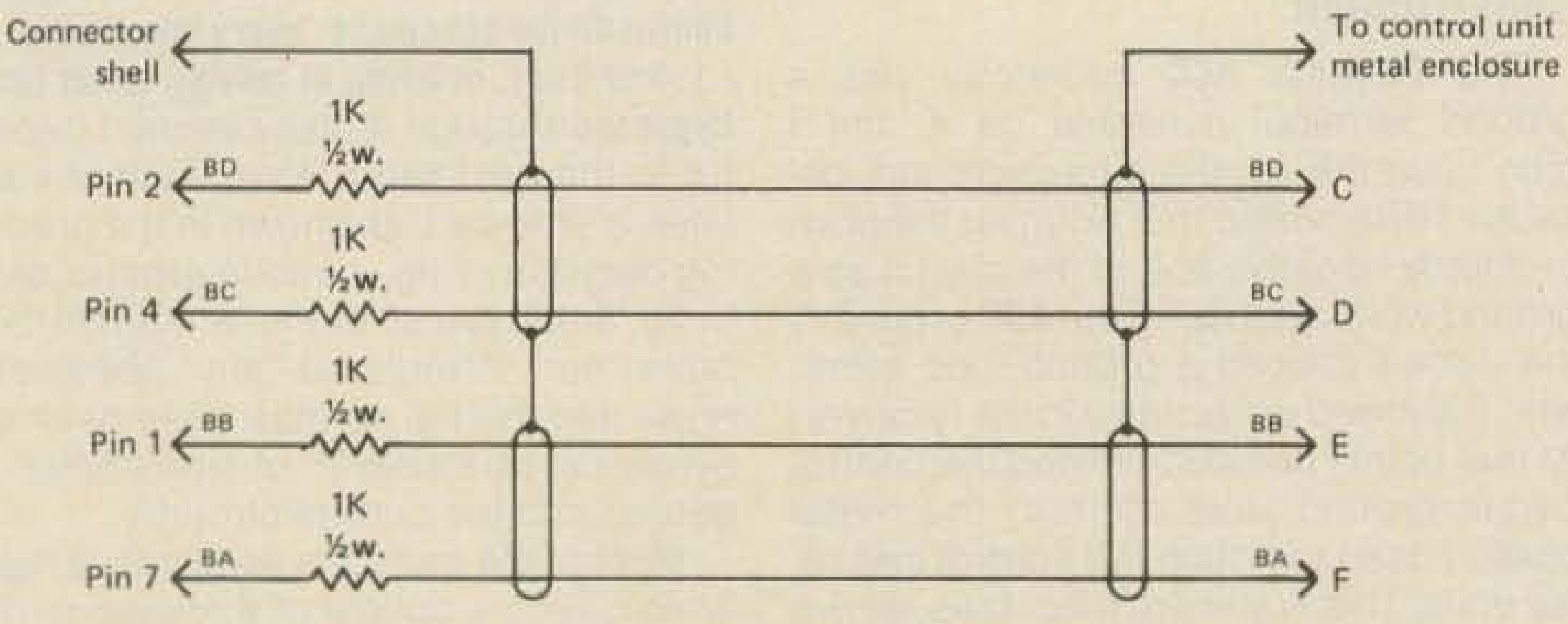


Fig. 6– Interface cable, TS-430S to control unit.

major parts and where I got them are listed in Table II. The only scrounging I did related to the connectors to bring the **ACC** lines into the control unit, and to bring the control lines out of the control unit and into the relay unit. I needed at least six or seven lines (counting shields, which I brought electrically through connector pins into the enclosures). Where to get affordable connectors with that many pins was a puzzlement, until I came across a box of octal plugs at a local (usually high-priced) electronics and parts emporium. They were selling them at 39¢ each! I grabbed a bunch of them and then ran home to attack an old vacuum-tube TV chassis which had been lying dormant in my basement just waiting to play such a role. A few minutes with my electric drill (to drill out the rivets on the octal tube sockets) and a soldering iron and I had a bunch of clean, keyed 8-pin connectors, both male and female ends, at 39¢ per set. If you can't manage such luck, you might try dismembering old vacuum tubes for their bases, or you can buy some of the classier (and much more expensive) computer-type connectors. No significant amount of current is carried, so there are numerous possibilities. You can consider combining the control and relay units into one enclosure, completely doing away with the need for two of the three control-line connectors. (However, beware of errant r.f. if you do that.)

One final trick: I put a 1K ohm resistor in series with each of the pins on the **ACC** plug that I used. These serve as isolation resistors, as shown in fig. 6, to prevent a recurrence of an event that occurred when I was testing a breadboarded version of the control circuit. I had accidentally shorted one or more of these outputs to ground in my lash-up. When I turned on the rig (my shiny new rig!) the display numerals did not light up! The panic that overwhelmed me in that instant is indescribable. Suffice it to say that I almost became a silent key on the spot. However, I quickly recovered and corrected the problem, and all was well again. When I built the cable to use permanently, I wired in the resistors so that should the other end of the cable accidentally short, the TTL output circuitry in the 430S would be afforded a large measure of protection, since only 5 ma at most would be caused to flow in or out of any pin in such an event. My control circuit logic is impervious to the addition of these protective resistors. In fact, it worked just as well with 3.9K ohm resistors in their place, but I felt that 1K ohm was adequate protection.

For Other Rigs

I could not begin to discuss rigs other than the TS-430S in any detail, but it should be possible to build a similar device for any rig that has output information regarding its frequency. For instance, some rigs have spare bandswitch positions brought out to the rear panel. These can be used without the decoder and inverter chips to drive the bases of transistors as in this design or to drive the relays directly. Be conscious of the need to carefully bypass control lines, though.

If your rig has no frequency information of this type, you might want to build just the rotary switch and relay unit portions of this design to give a remote switching capability. Unfortunately, this will not provide you with automatic antenna selection.

Operation

Once the automatic TS-430S antenna selector is built and in operation, you can forget about it. Once in a while check the LED's and your s.w.r. meter to make sure all is still okay. However, you can change bands at will, automatically scan across bands, and use all of the frequency versatility built into the rig without concerning yourself about the antenna. If you're waiting to break a pile-up on one band, you can put that frequency into memory, jump to another band for a quick QSO, then recall the original pile-up frequency and be ready to call without ever touching an antenna switch. No muss, no fuss . . . it works!

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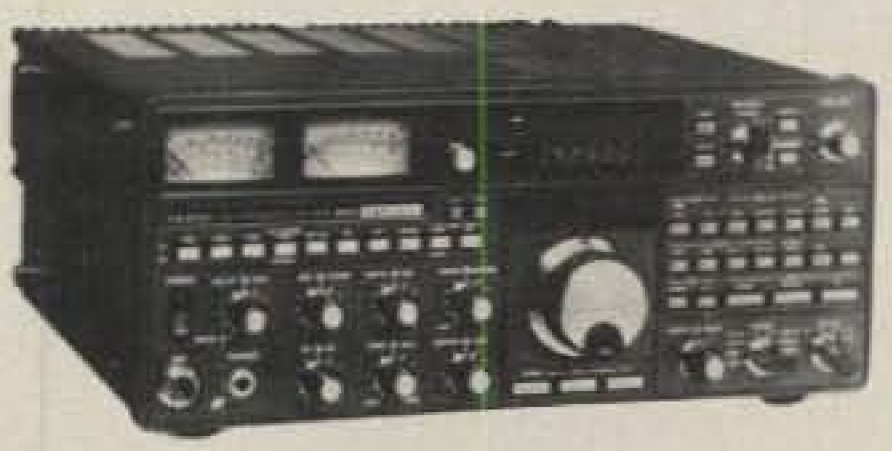
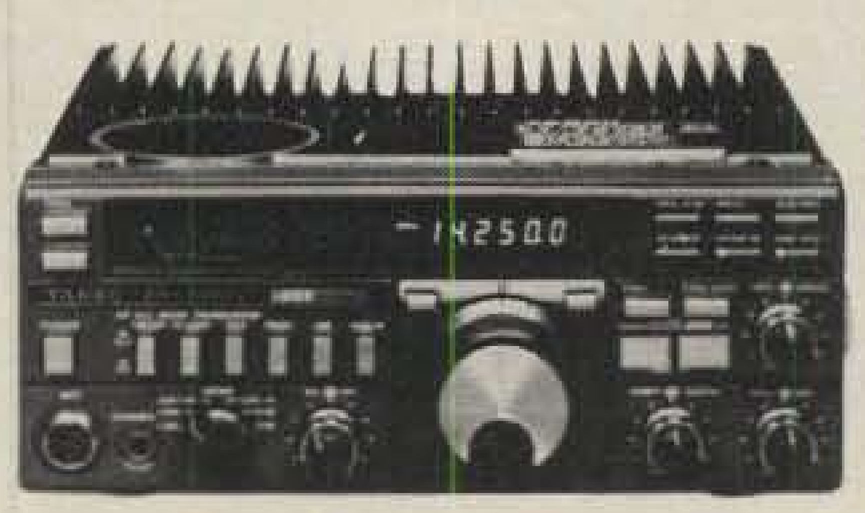
KENWOOD TS-7950


YAESU FT-980 CAT SYSTEM

ICOM IC-25A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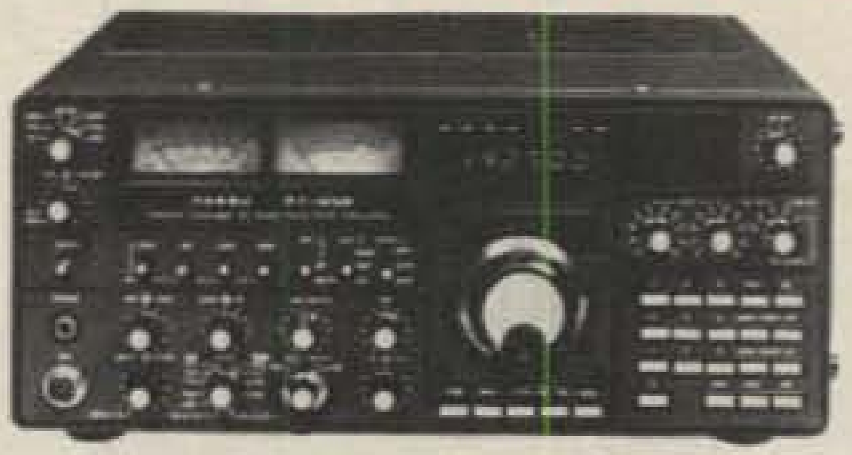
FT-208R

KENWOOD TR-2500

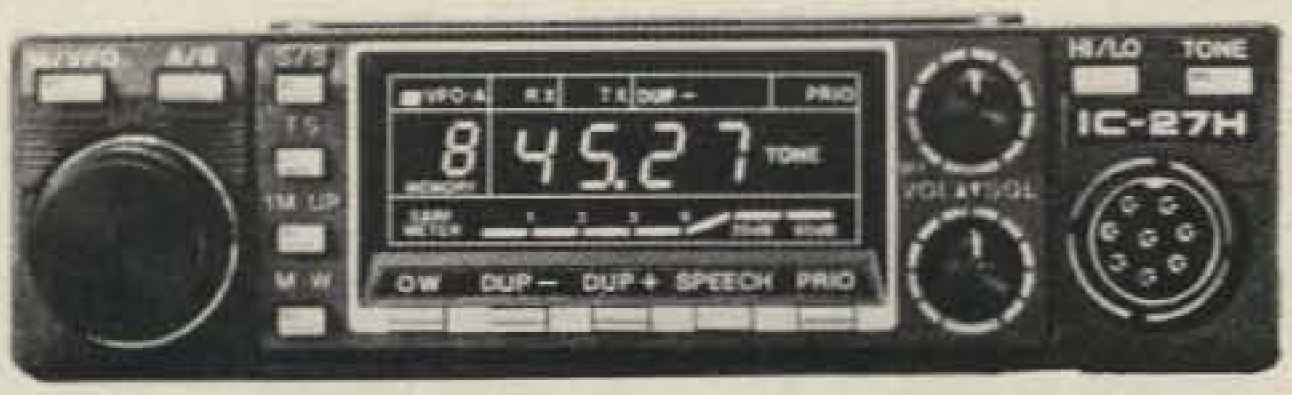

YAESU FT-ONE

YAESU FT-102

KENWOOD TS-930

ICOM IC-02A

KENWOOD TS-430S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TRS-80C	●	●			
TI-99/4A	●				

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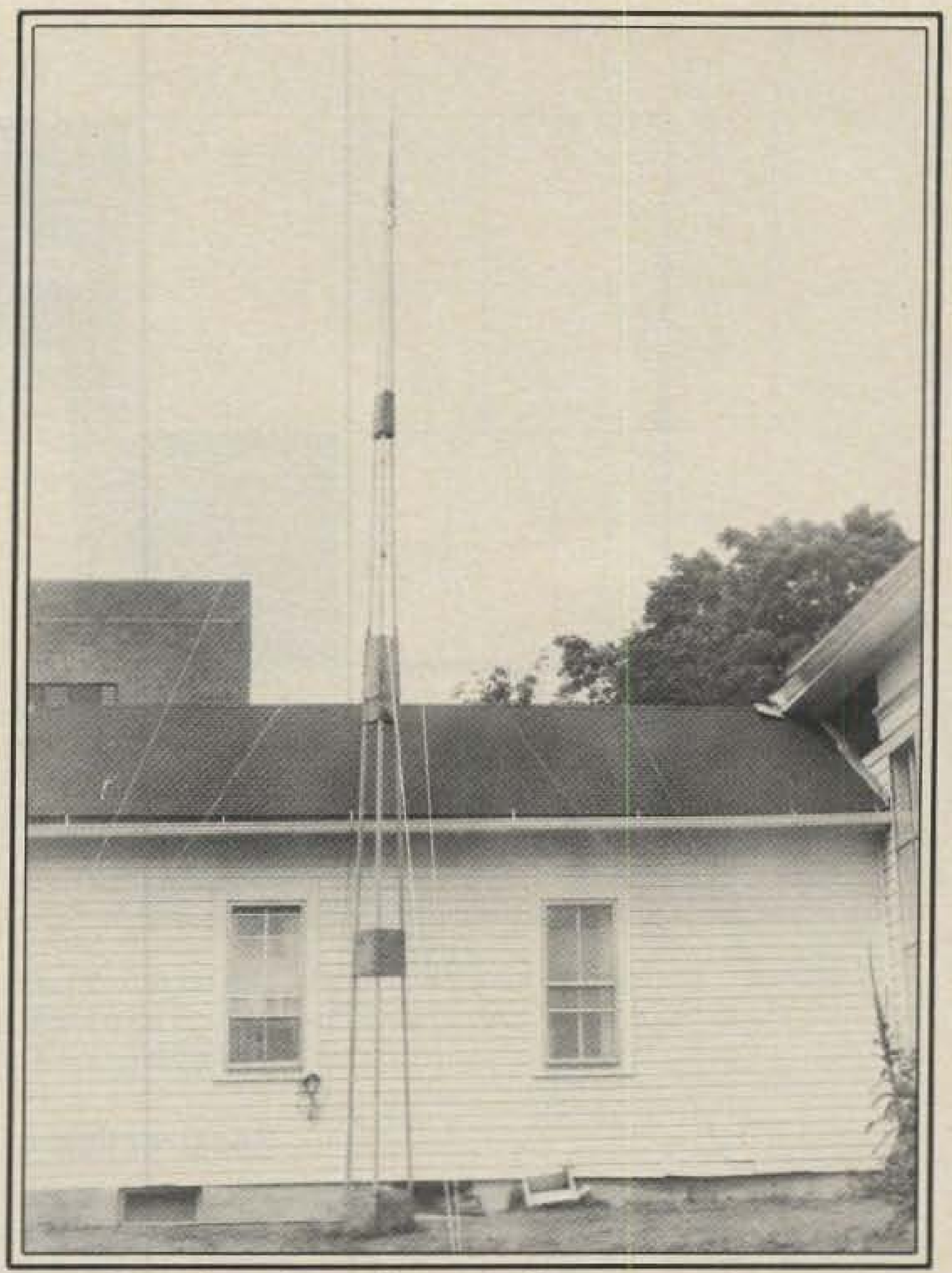
This may qualify as the 101st thing you can make with a sheet of plywood. WA2JHD presents a home-improvement magazine-type project for the do-it-yourselfer.

HOW TO BUILD A PLYWOOD TOWER

BY BILL GREENE, JR.* WA2JHD



Complete plywood tower with two sets of guys.

Let there be no mistake about it: I've always been a plywood nut. I love the stuff, and I'll try anything with it. It's been that way ever since the days when I worked with a construction firm. After I got into amateur radio, naturally enough came the thought why not make an antenna tower out of plywood?

This idea festered in the back of my mind for several years. Then just a short while ago I was thumbing through Bill Orr's *Simple, Low-Cost Wire Antennas For Radio Amateurs,* and I discovered a neat design for a 10-15-20 meter ground plane meant to be hung from a tree. Deep down in my plywood brain the two ideas fused together, and I decided to do something about it.

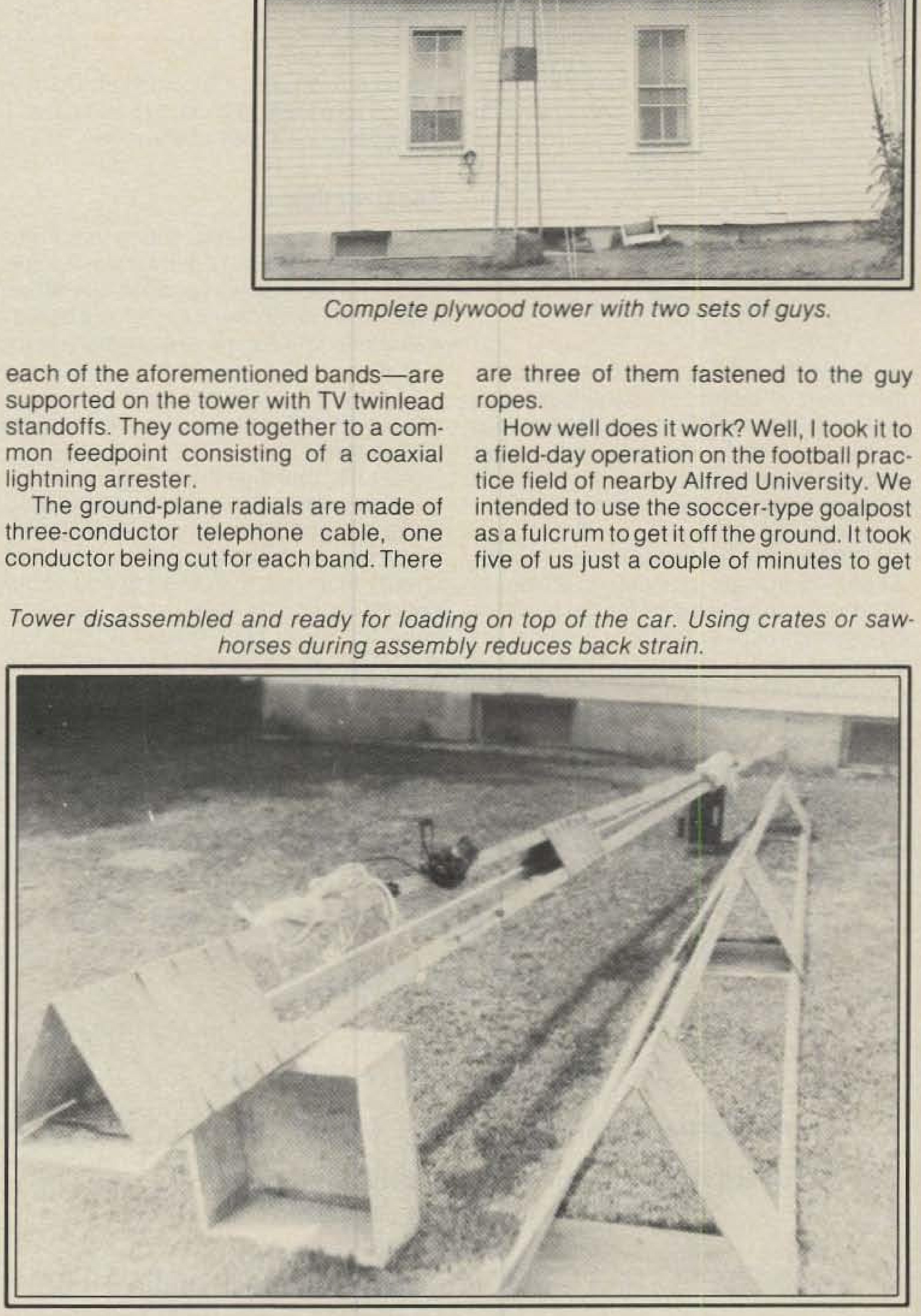
By nature I'm a tightwad, so naturally I had to build this thing using no more than one sheet of plywood. The tower had to be as tall as possible, and since I'm a field-day freak it had to be transportable. When the wheels finished turning and the sawdust settled down, I had a tower made entirely of wood. It stands about 36 feet high and supports a 3-band ground-plane system.

Since the tower is not meant to be set on a foundation, it is kept upright by guy ropes fastened to 4 foot iron pipe stakes. A ground wire runs down through the center. Three vertical antennas—one for each of the aforementioned bands—are supported on the tower with TV twinlead standoffs. They come together to a common feedpoint consisting of a coaxial lightning arrester.

The ground-plane radials are made of three-conductor telephone cable, one conductor being cut for each band. There are three of them fastened to the guy ropes.

How well does it work? Well, I took it to a field-day operation on the football practice field of nearby Alfred University. We intended to use the soccer-type goalpost as a fulcrum to get it off the ground. It took five of us just a couple of minutes to get

Tower disassembled and ready for loading on top of the car. Using crates or saw-horses during assembly reduces back strain.



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*20 Willets Ave., Belmont, NY 14813

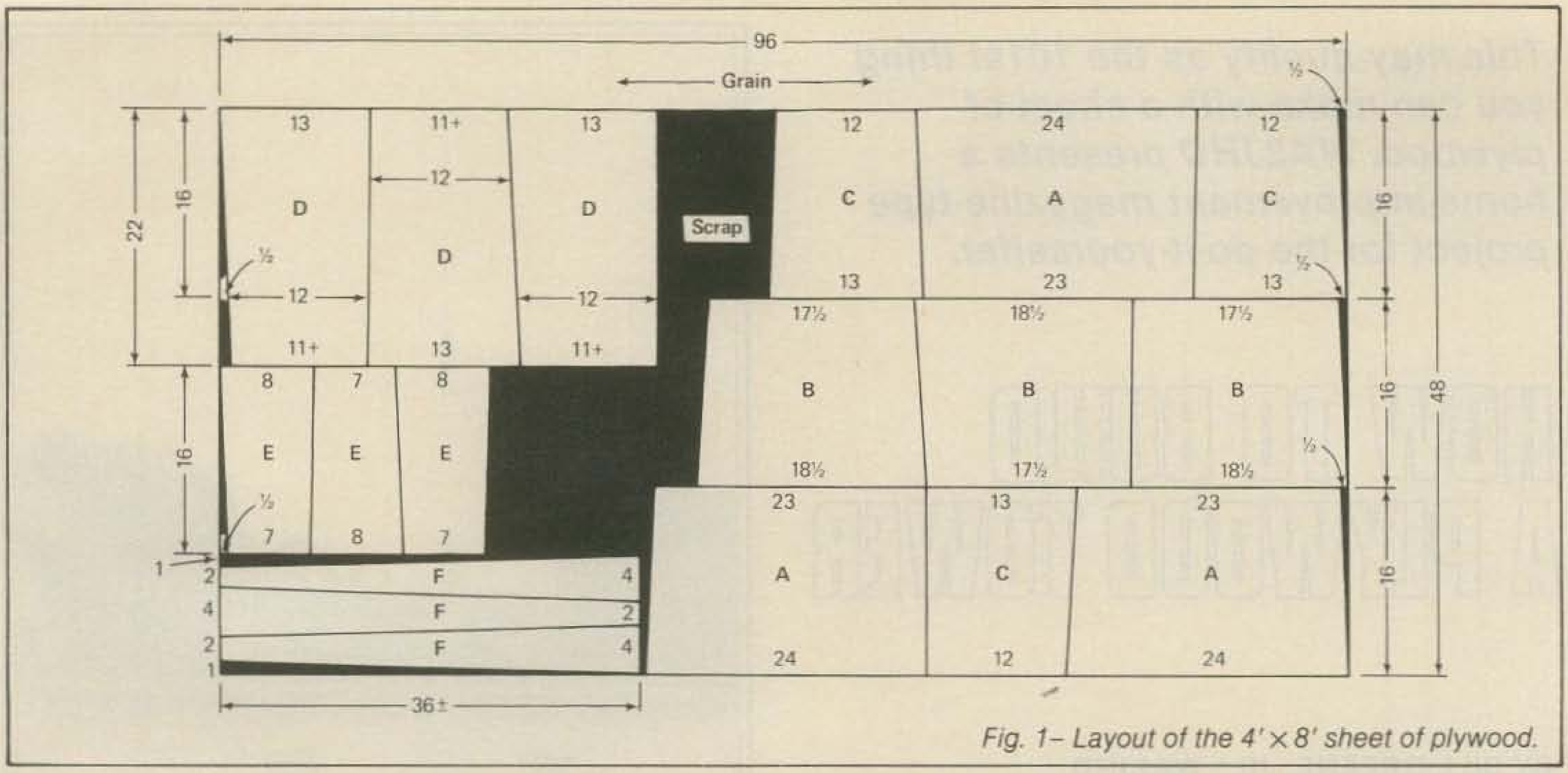

Fig. 1– Layout of the 4′ × 8′ sheet of plywood.

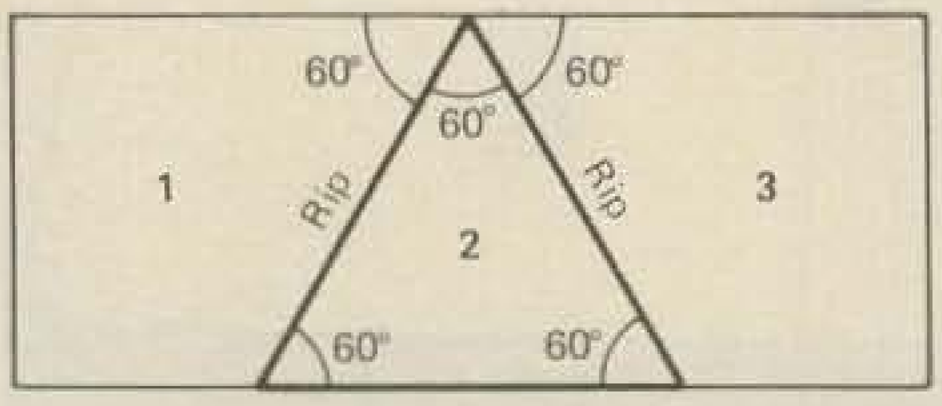

Fig. 2– A section of 2″ × 4″. Set your table saw blade at 60°.

up. Since the ground was not suitable for the stakes (6 inches of topsoil over bedrock), we tied two of the guys to the legs of the goalpost and the third to a car bumper. It looked grand with that little American flag fluttering from the top.

The results were well worth it. Of the first 23 hours of field day, we were on the air only 12 of them (catnapping and lousy band conditions account for the rest). On 20 we made over a hundred contacts. We switched to 10 for the last hour and logged 25 more. In all we reached 34 states, 4 provinces, Cuba, and the Virgin Islands. All contacts were beyond the first, second, and third call areas.

The tower cost me a total of about $30.00. With a permanent installation, I see no reason why you couldn't build one as high as 64 feet. (Of course, you'd need more than one sheet of plywood.)

Construction

Lay out the plywood, noting the direction of the grain (fig. 1). If the tower is to be built in two take-down sections, use all six patterns. Omit gusset **C** if it is to be built in a single length for a more permanent installation.

Rip the 2″ × 4″'s into three triangular sections (fig. 2). These will be the uprights for the tower.

If you are building the tower in two sections, assemble the bottom section first, using the photos and fig. 3 as a guide. When you do the upper section, note that it must fit snugly over the top end of the bottom section. In other words, gusset **D** must fit snugly over gusset **C**. You will probably get the best fit if you assemble the top section directly over the end of the bottom section. Add the 2″ × 2″ section to the peak inside gusset, applying a little fudge factor as needed.

Now drill three holes in a triangular pattern through each pair of gussets **C** and **D**, and bolt the two sections together. You may want to double-nut the bolts. Let the glue set overnight.

Bill of Materials

1	sheet exterior plywood, 4′ × 8′, ¼″ or thicker
4	good quality (no knots or warps) 2″ × 4″ × 8′
200′	nylon line (about ¼″)
60′	braided copper wire
50′	three-conductor telephone wire
6	4 foot lengths ½″ iron pipe (for guy stakes)
1	coaxial lightning arrester
9	¼-20 bolts, 1 inch long, with nuts, flat and lock washers
4′	2″ × 2″
6	l bolts long enough to go through the 2″ × 4″s
2	ground clamps
Coax cable, at least 50 feet	
Waterproof glue and annular nails	

While the tower is still lying on the ground, begin wiring it from the top down. Cut a length of braided copper wire to a quarter wave at 20 meters, and fasten it to the peak using a TV standoff. Put another standoff about a foot from the bottom end of the wire. Then temporarily tack the end of the wire to one of the uprights. From this point, run the 15 meter wire up a second of the tower uprights. Run a 10 meter wire up a third upright. (You may want to position the three antennas so that one side of the tower will be clear for resting on the ground prior to raising.)

If you've done everything right, you should have a foot of wire free on each of the bottom ends (temporarily stapled to the uprights, remember?). Join the three together, soldering them into a banana plug. This should fit snugly into the center portion of the coax lightning arrester. The coax to your rig is then connected to the

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Fig. 3– Plywood tower construction details.

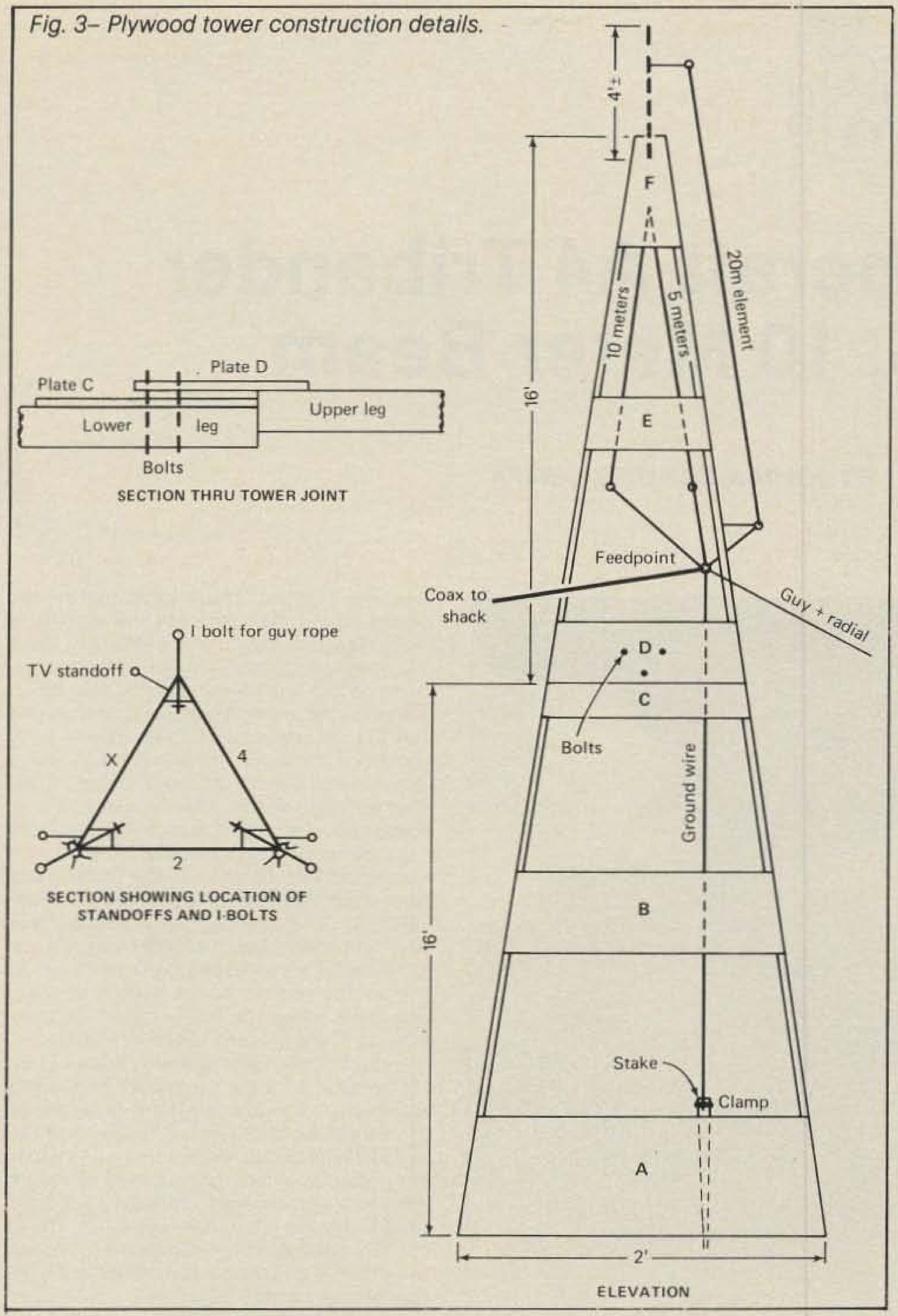
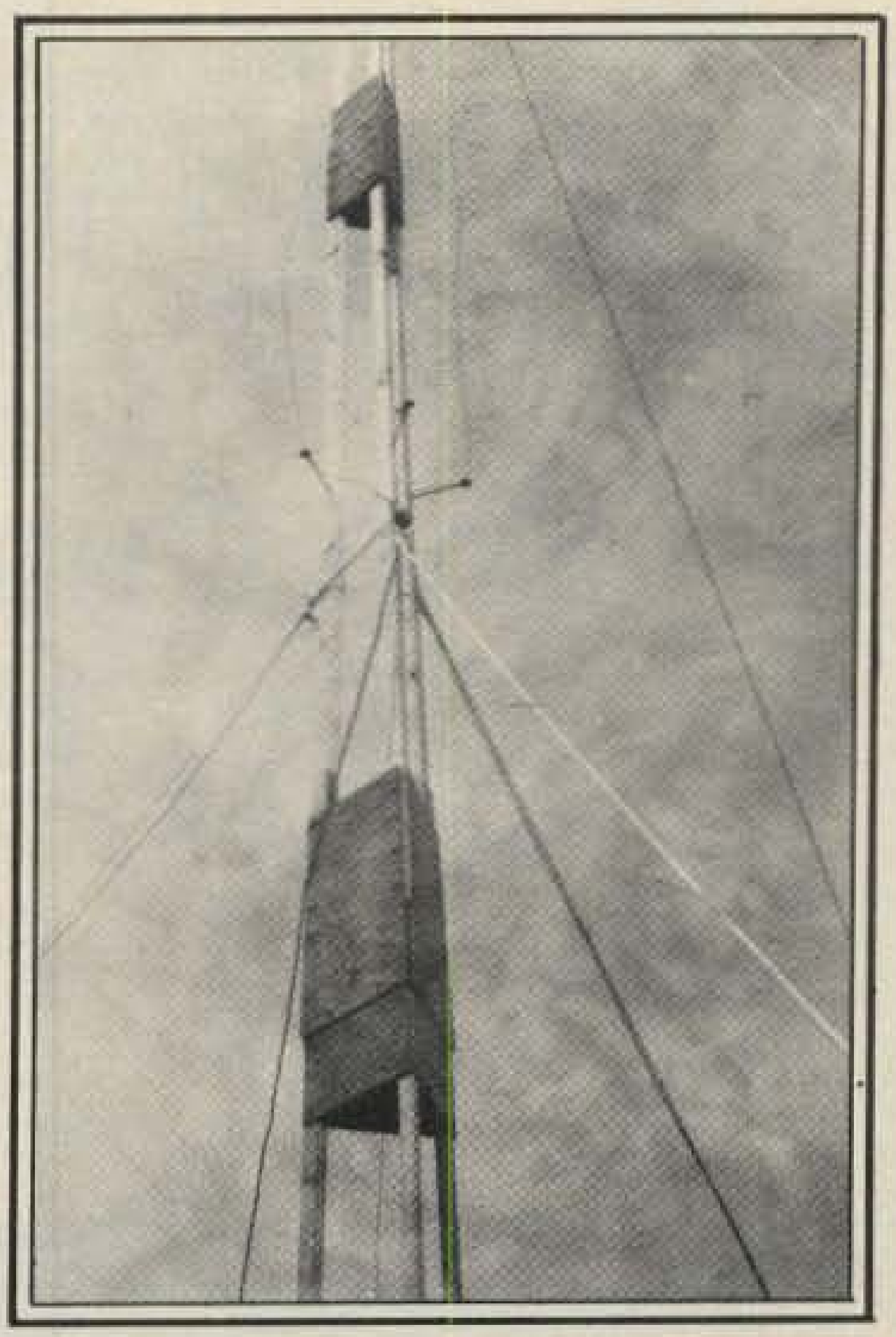
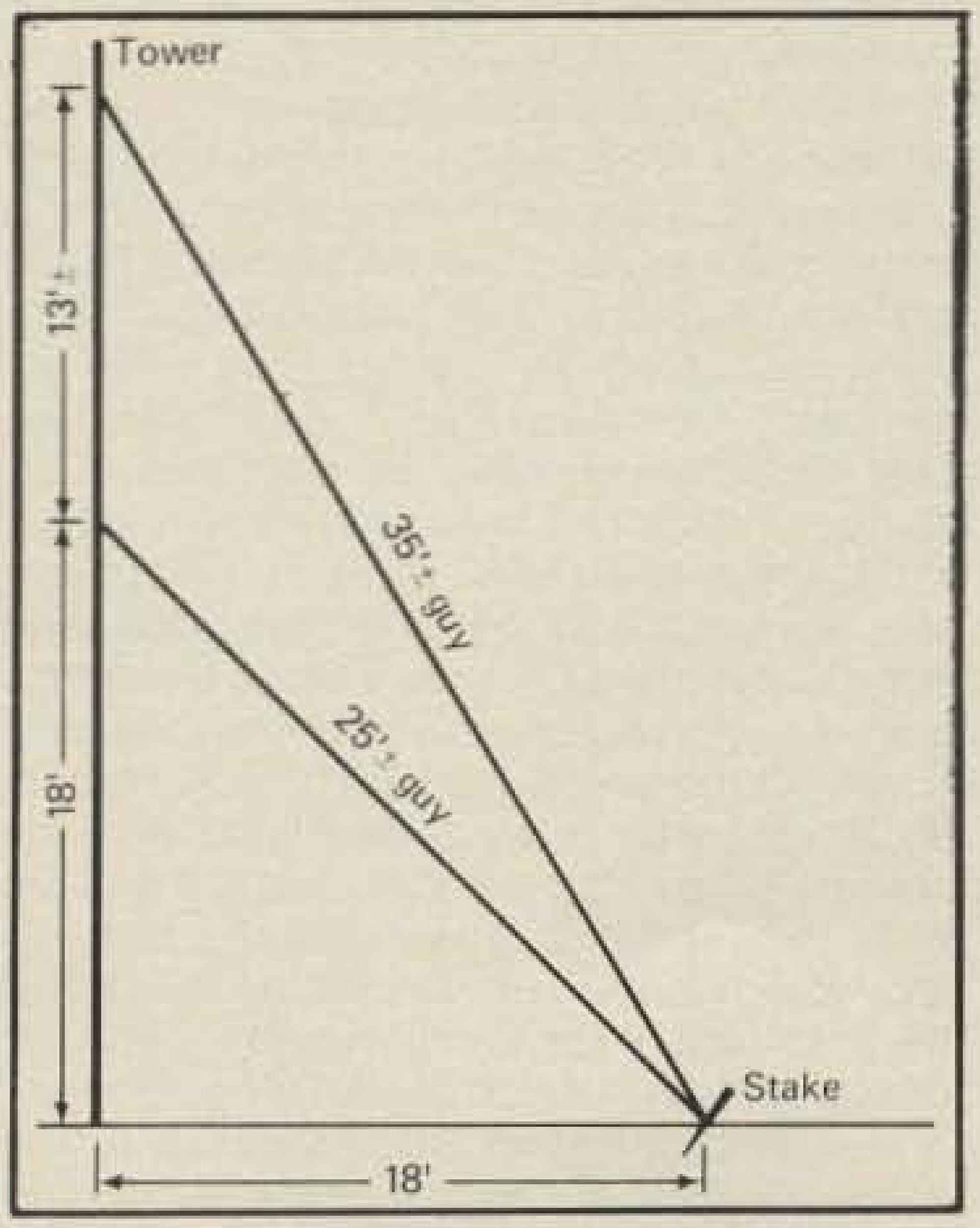


Plate C
Plate D
Lower leg
Upper leg
Bolts
SECTION THRU TOWER JOINT
I bolt for guy rope
TV standoff
X
4
2
SECTION SHOWING LOCATION OF STANDOFFS AND I-BOLTS
4'±
F
10 meters
5 meters
20m element
16'
E
Feedpoint
Coax to shack
Guy + radial
D
C
Bolts
Ground wire
B
16'
Stake
Clamp
A
2'
ELEVATION



This view shows the feedpoint and the section connecting gussets.



Tower
13'±
35'± guy
25'± guy
18'
Stake
18'

Fig. 4– The guying arrangement.

other end of the lightning arrester with a PL-259 plug. The ground screw of the lightning arrester connects to a conductor (the unused remnant of the braided wire) that reaches down to a ground connection. Mount the lightning arrester to one of the tower uprights with a pipe clamp.

Cut three pieces of indoor, three-conductor telephone cable to a quarter wavelength at 20 meters. Measure and mark a quarter wavelength for 15 meters, and for 10 meters on each cable. Carefully cut into the insulation at each of these points. Cut one of the conductors at the 15 meter point, and cut another conductor at the 10 meter point. Draw out the unused lengths of the cut conductors. If you do it right, you should have one conductor cut for each of the three bands. Join together all of these conductors from each of the three cables, and connect them to the ground screw of the lightning arrester.

What you have done is build three ground-plane antennas onto the tower, one for each band, using a common feedpoint. Once the tower is raised upright, the ground-plane radials will use the guy ropes as supporting messengers. The tower is now complete. All you need to do is get it standing up.

I first set up mine at my office, the Allegany County Museum in Belmont, New York. If you know the location, perhaps you can appreciate a 5 by 8 signal report from Washington State using less than 100 watts.

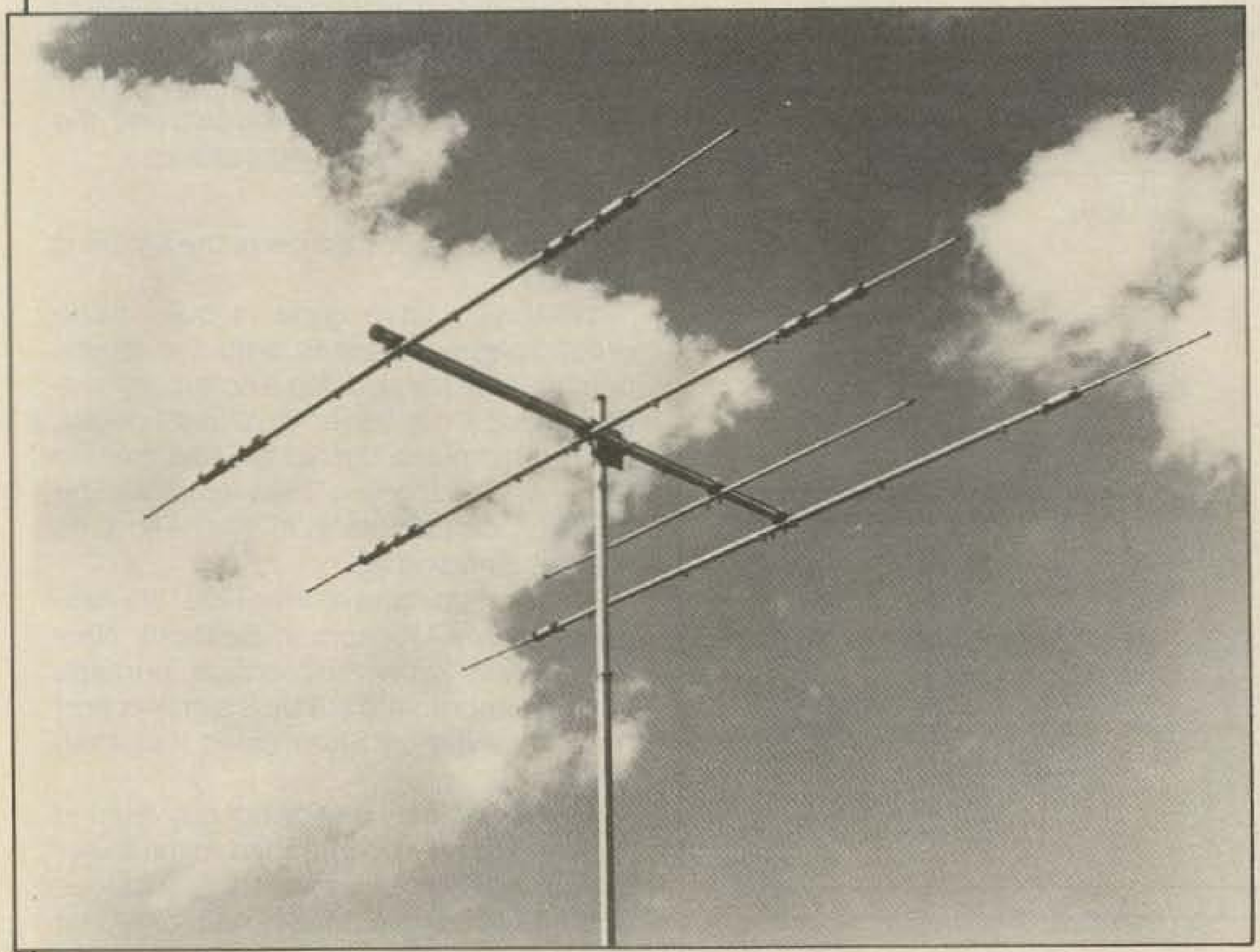
There was only one set of guy lines at first, and they were attached to the tower at the feedpoint, about 18 feet above ground. After the tower had been up about two weeks, we had a wild storm with winds gusting up to 40 m.p.h. The top of the tower shook out its bolts and buckled. The damage was slight, and a couple of days later I was back in operation. This time I had two sets of guys—one in the original position and one attached higher up. The guys were anchored to three stakes (made of 4 foot lengths of iron pipe), and three more were driven just inside the base to keep it from shifting. One of them also served as a ground rod.

So there it stands on the hillside in Belmont, New York, performing beautifully. Once in a while I get a wisecrack or two, but they usually fade away when the results are demonstrated. The only exception came when my brother, WB4LXF, stopped by. Then the best DX I could show off was with a new General 200 yards down the street! Still, although it doesn't look like much, I built it and it works. Isn't that part of what amateur radio is all about? CQ

CQ REVIEWS:

The Cushcraft A4 Tribander 20, 15, 10 Meter Beam

BY JOHN J. SCHULTZ*, W4FA



The Cushcraft A4 Tribander 20, 15, 10 meter beam.

Do surprising things come in relatively small packages? In the case of the Cushcraft A4, the answer certainly has to be yes. The package in which the A4 arrives is not miniature, being 6½ feet long by 6 inches square, but it is tremendously small compared to the triband beam antenna which comes out of it. The beam has some impressive specifications, as shown in Table I.

What comes out of the package is a total of some 154 parts, ranging from all sorts of lengths of aluminum tubing, to trap assemblies, to assorted mounting hardware. At first the sheer volume of parts seems confusing, but in reality there is no reason for concern. One does need a bit of room to assemble the beam, but assembly itself is extremely straightforward. For instance, fig. 1 shows the boom-to-mast assembly. The instructions give a very clear pictorial of the assembly procedure, individual pictorials of every part involved, descriptions and dimensions of the parts, etc.

Of course, fig. 1 has been taken out of context a bit. When it is seen together with the rest of the assembly instructions, it really does become very clear. Assembly of the A4 requires only simple tools such as screwdrivers and hex wrenches. Almost anyone should be able to assemble the antenna confortably in a few hours. Of course, as with the assembly of any beam antenna, it is highly recommended that one take plenty of time to assemble it slowly and carefully and that one use extreme care not to scratch or dent the various parts. After all, once the beam goes high up on top of a tower, one doesn't want to have to take it down after a short period for repairs.

The quality of the parts used for the A4 is excellent. Care was taken by the manufacturer to provide all those "small" things that eventually mean long beam life: moisture drain holes in the trap assemblies, lockwashers at every necessary point, etc. Cushcraft does not recommend that any special sealers, etc., be applied over the antenna parts, and undoubtedly they are not necessary for the majority of installations. However, I personally like to buy a little extra bit of insurance and have often applied a polyurethane sealer on nut, U-bolt, screw heads, and other assemblies, since one can't completely avoid very slightly scratching the surface finish on many of the metal parts during the assembly process. Considering the low cost of such a sealer versus the investment one makes in a large beam, I'd rate the sealer a very inexpensive investment. Of course, the sealer must be applied as specified. If it is carelessly applied and traps moisture, its whole process will be defeated.

Even the use of such a sealer, however, will not protect antenna hardware from really harsh environmental conditions (e.g., a location very close to salt water) for any extended period. Much to Cushcraft's credit, and apparently obvious of their commitment to the A4, they market a separate stainless steel hardware kit for the A4, namely the A4SK. The kit contains stainless steel hardware to replace U-bolt and worm clamp assemblies in the A4. Not too many amateurs will need the A4SK accessory kit, but it is useful to note that it is available.

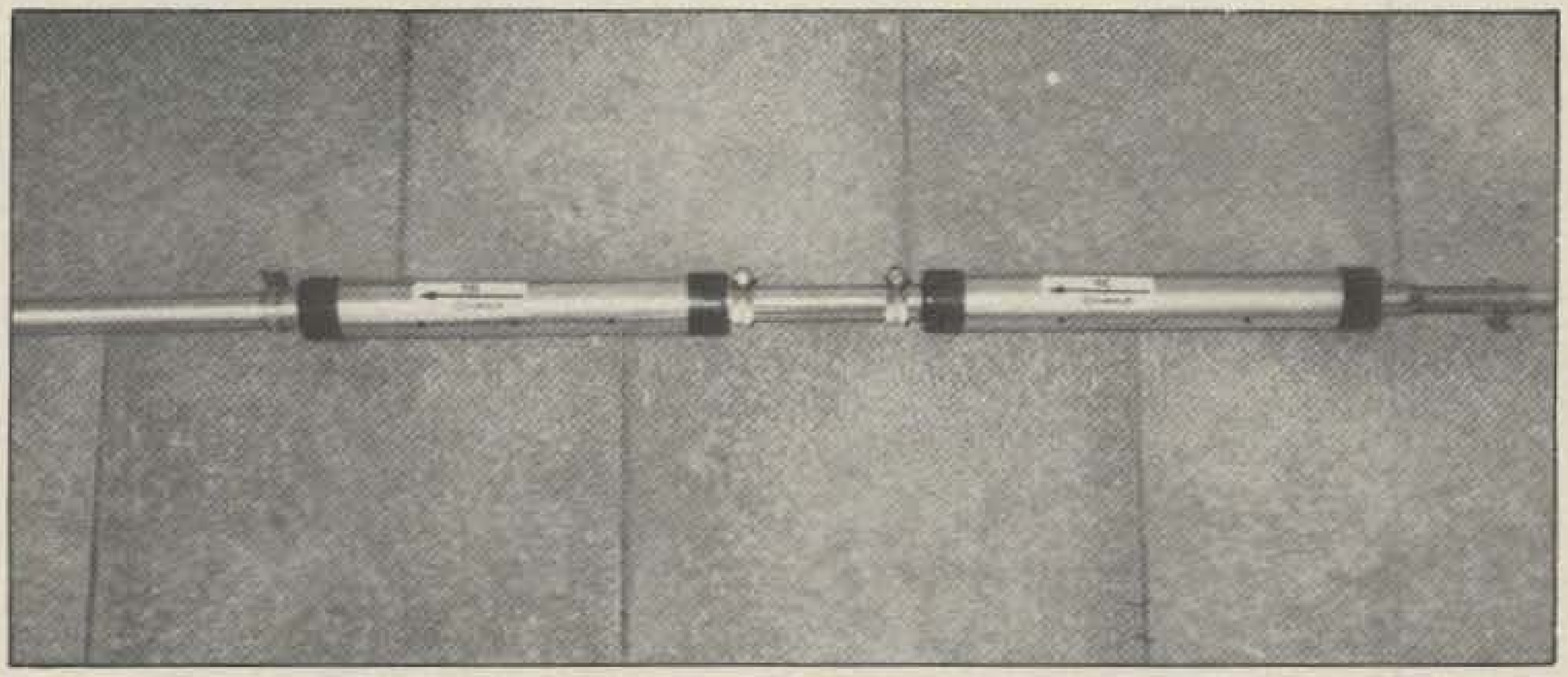
The A4 actually assembled went together without any difficulty. The photograph of the trap assembly shows the typical construction of that assembly and how the elements in general are assembled using worm clamps. There are a total of 34 such clamps used in the assembly of the beam. All of the elements, except the driven element, are electrically connected to the boom. The driven element is split at the center and a 10 inch long by 1 inch diameter fiberglass insulator joins both halves and is itself held to the boom by a U-bolt assembly. It is not necessary to use a balun, but one must construct the simple feedline choke shown in fig. 2 using a bit of the coaxial feedline to the antenna. The choke can be taped to the boom near the feedpoint. The Cushcraft diagram shows some tape used to seal the feedline at the point where the center dielectric and the braid separate. Instead of tape a coaxial sealer was used, since if moisture should enter the cable, it eventually will cause the braid to rot out inside the cable. Again, I think it is par-

---

*c/o CQ Magazine

A4 Specifications			
Forward Gain:	8.9 dBd	Wind Surface Area:	5.5 sq. ft. (0.51 sqm)
Front to Back Ratio Avg:	25 dB		
VSWR:	1.2-1 Typical	Weight:	37 Lb. (16.8Kg)
Bandwidth (Avg):	500 KHz	Turning Radius:	18 Ft. (548.6 cm)
Power Rating:	2000 W PEP	Mast Diameter:	1¼" to 2⅛" (3.2 to 5.4 cm)
Feed Point Impedance:	50 OHMS	Material:	6063-T832 Seamless Aluminum
Connector:	Twin terminal. Takes all Coax.	Telescopic Method:	Taper tubing with full circle clamps
Hardware:	Zinc Plated Steel		
Boom:	2" x 18' (5.1 x 548.6 cm)		
Longest Element:	1⅛" - ½" x 31'4½" (2.9 to 1.3 x 956.3 cm)	UPS SHIPPABLE No Balun Required	

Table I– Manufacturer's specifications for the A4.



Assembly of the beam is facilitated by clear assembly instructions and clearly labeled traps. Worm clamps are used throughout to fasten different diameter telescoping sections of aluminum tubing as shown here by one of the dual trap assemblies on the driven element.

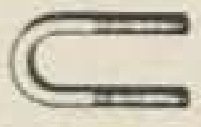
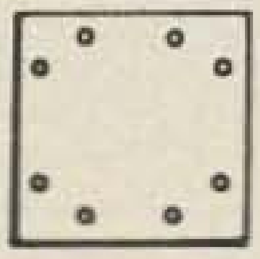
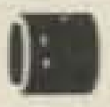
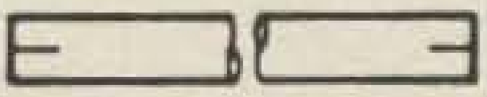
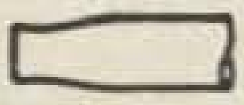
ticularly important to take time to make and seal connections solidly while a beam is on the ground.

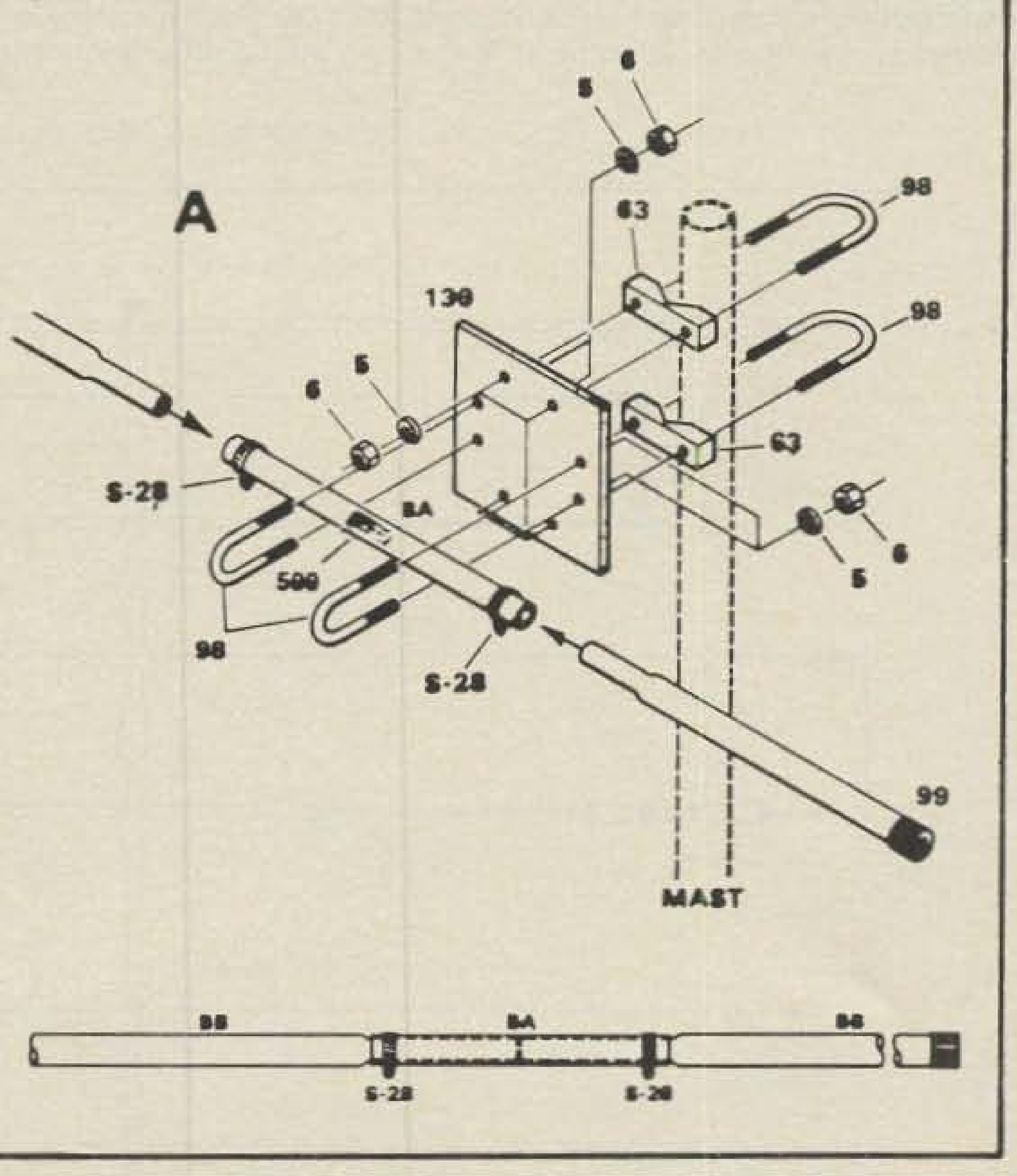
The assembled beam looks as shown in fig. 3. The spacing between the elements remains fixed as shown on the right of the diagram. However, some 13 other dimensions must be set for various tubing sections, depending upon whether one wants to set the beam for best s.w.r. in the center of each band or to favor the c.w. or phone portion of each band. For instance, dimension D1 in fig. 3 will vary from 30′ 8¼″ for phone band portion coverage, to 31′ 1¼″ for band center coverage, to 31′ 4½″ for c.w. band portion coverage. Fig. 3 only shows four of the dimensions which must be set. The rest are the tip ends on the traps, spacing between traps, etc. The assembly instructions for the A4 contain a complete listing of the dimensions which must be set and very clear diagrams so one can easily identify each beam section which must be set before all the worm clamps are tightened. The dimensions chosen set the beam for all three bands. That is, one cannot simultaneously optimize the beam's dimensions for the c.w. portion of 20 meters and the phone end of 10 meters.

The A4 used here demonstrated surprisingly broad band performance. Of course, individual results will vary depending on the height at which the beam is installed, the proximity to nearby objects (particularly metallic ones), and other circumstances. The antenna was mounted at about 50 feet in an area of other h.f. antennas, although none was in really close proximity in terms of wavelength. With the antenna dimensioned for best center band performance, the s.w.r. did not exceed 1:1.2–1.4 at either extreme end of 20 or 15 meters, and only started to exceed 1:1.4 on 10 meters above 29 MHz. The solid-state Ten-Tec Corsair transceiver used with the antenna did not

Boom to Mast Assembly

Fig. 1– An example of the particularly clear assembly instructions which come with the A4.

P/N	DETAIL	DESC.	SIZE	QTY
6		HEX NUT	5/16" (.8cm)	8
5		SPLIT WASHER	5/16" (.8cm)	8
98		U-BOLT	2½" (7.9cm)	4
130		ALUM. MTNG PLATE	3/16" x 6" x 6" (.48 x 15.2 x 15.2cm)	1
63		"V" BLOCK	2½" (6.4cm)	2
S-28		WORM CLAMP	1 5/16" x 2 1/4" (3.3cm x 5.7cm)	2
99		BL. PLASTIC CAP	2" (5.1cm)	2
BA		ALUMINUM TUBING	(5.1 x 182.8cm) 2"OD x 72" x .058" WALL	1
BB		ALUMINUM TUBING	2"OD x 75¼" (5.1 x 191.1cm) x .058" WALL SWAGED	2



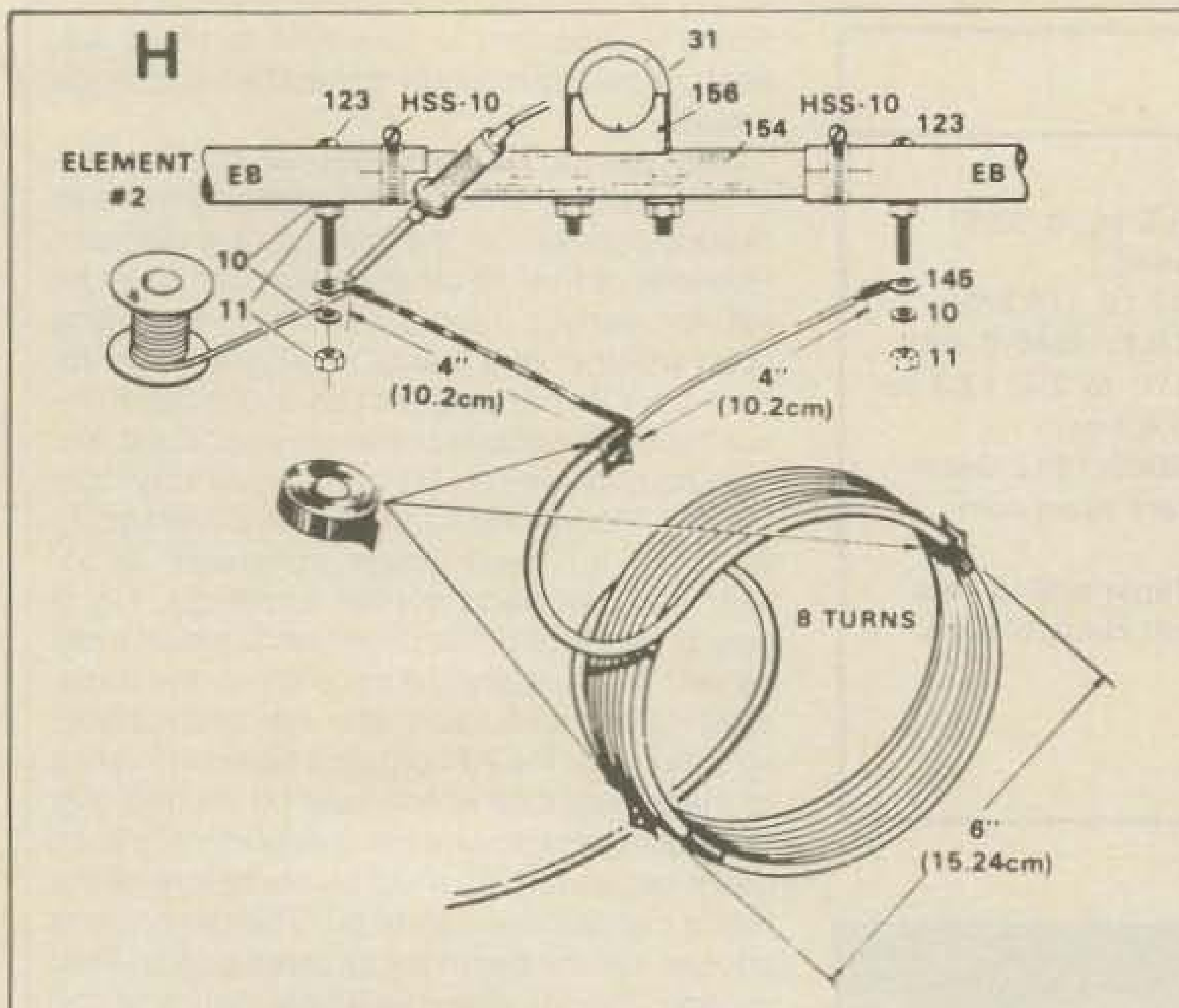
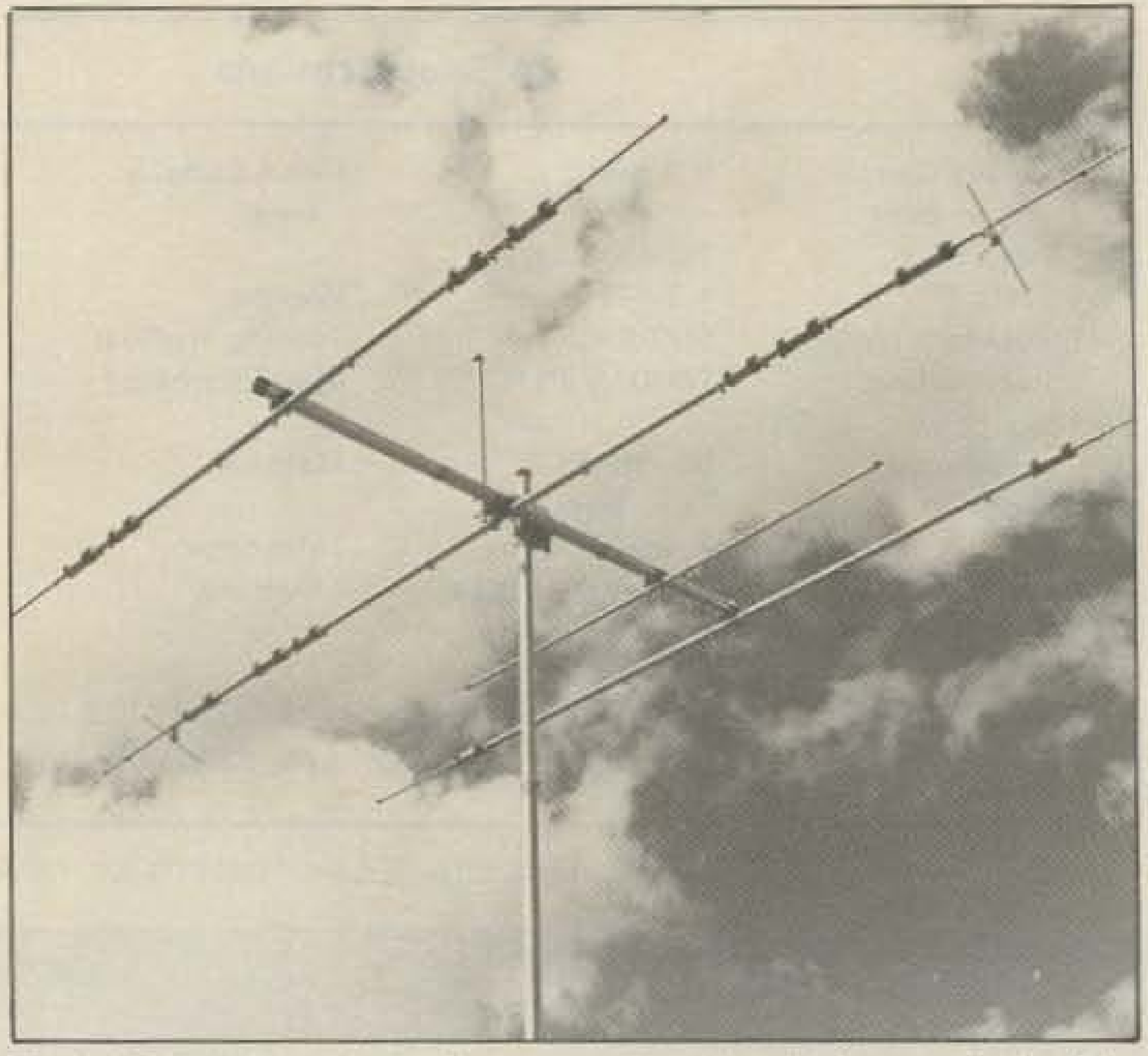


Fig. 2– A balun is not needed with the beam, but one must construct this simple line choke from the coaxial transmission line used with the antenna at the point where the line connects to the driven element.



The A4 Tribander with the 30 meter add-on kit, which extends the driven element by adding another set of traps to it plus some capacitive top hats for end loading.

require any antenna tuner to maintain essentially full power output (except above 29 MHz). However, I'll be the first to confess that I don't feel comfortable with even a 1:1.2 s.w.r. Maybe that feeling comes from being around high-power shortwave broadcasting transmitters for too many years and seeing what things really high power can burn up when transmission line s.w.r. increases. Therefore, for most periods of operation I used a simple antenna tuner with the Corsair/A4 combination, but it is hardly an example anyone needs to follow.

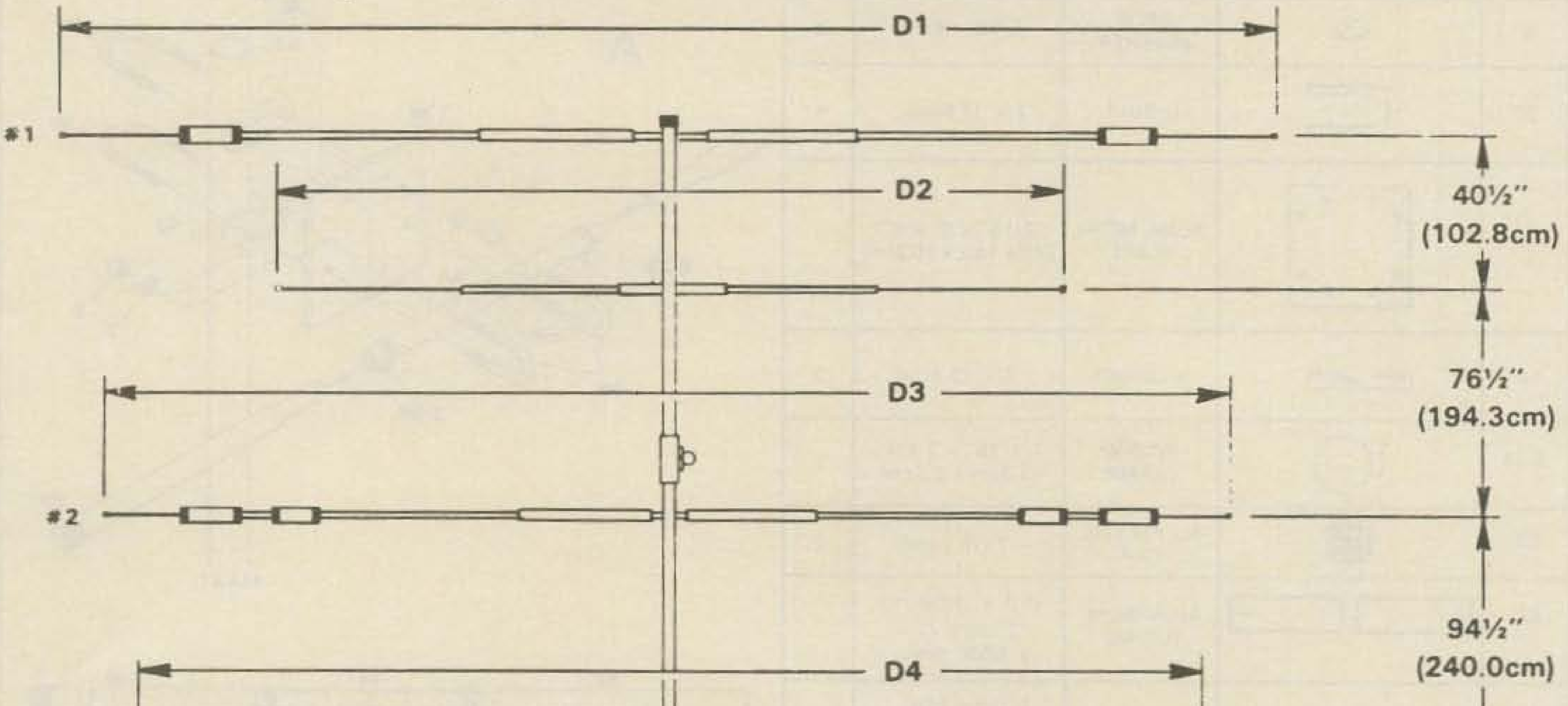
Using the A4 with the barefoot Corsair provided extremely satisfying results. I'm not a contest operator, so I can't present some great scores as proof of the A4's effectiveness. However, I worked any station I could hear, and more often than not I penetrated DX pileups on the first try or within a few tries. However, all of that is a very general evaluation. About the best objective evaluation I could make was to compare my received signal report with that of other stations using the same power level but with different beams. On that basis, the A4 seemed to perform about the same or very slightly worse than a full-size, wide-spaced, three-element beam on 20; the same as any such full-size antenna on 15; and notably better than any conventional or trap-type three-element beam on 10 meters. I would rate those results as being very good indeed for the A4 as a triband beam.

The A4 is rated for 2 kw PEP, but no power checks were made. However, just considering the rugged construction of the antenna elements, traps, etc., there would appear to be every reason to believe that the antenna will easily accommodate the 2 kw PEP level.

Besides the optional stainless steel hardware kit available for the A4, there is also available a 30 meter add-on kit. The kit apparently extends the driven element by adding another set of traps to it and some capacitive top hats for end loading. It would certainly seem to be a very convenient way to add another band to the A4.

The antenna does carry a one-year warranty to cover any possible defects in materials or workmanship. As was mentioned before, the instructions included with the A4 are very good and very clear. They emphasize, besides assembly of the antenna, the safety precautions that one should take when installing a beam. One shouldn't forget that putting together a big beam on the ground isn't very difficult, but installing it on a tower requires careful advance planning.

Fig. 3– The completed beam. Some of the "D" dimensions are discussed in the text.



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Once you have something explained, it's no longer a mystery. KG5B takes the time to explain just what it is that a lot of us use.

Exploring The Vagaries Of Traps

BY CORNELIO NOUEL*, KG5B

At one time or another most of us have used traps in our antenna systems. A trap is simply a resonant circuit consisting of a capacitor in parallel with an inductor. Series resonant traps are sometimes used to reduce or eliminate undesired responses from oscillators or amplifiers. This article, however, will deal only with parallel resonant circuits as they are used in multiband antennas. In the old days parallel tuned traps, or "wave traps" as they were then called, were used in series with the receiver antenna lead-in to reduce blocking from strong nearby stations or perhaps to decrease the strength of second or third harmonic emissions from the transmitter (fig. 1). More recently, however, traps have become quite popular in the design of multiband antennas, since they provide economical and automatic band-selection capability (fig. 2).

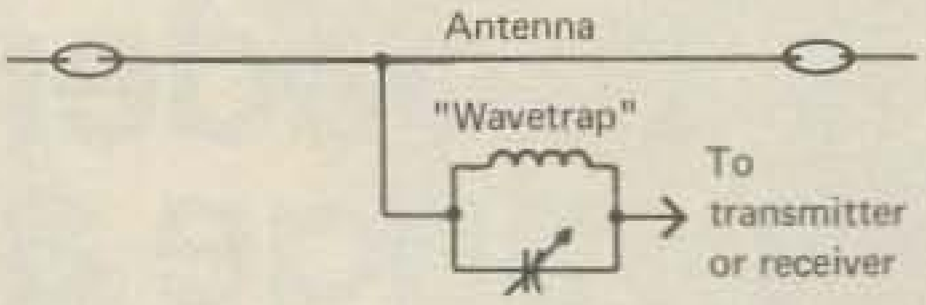

Fig. 1– An old-time "wave-trap."

The idea of multiband antennas using traps is based on the principle that parallel resonant circuits offer a very high impedance path at their resonant frequency, thus acting as isolators. As the frequency is lowered, they essentially become inductive, acting as loading coils for the next lower bands.

The simplest trap is a single-layer close-wound coil or solenoid that by virtue of its inherent distributed capacitance is self-resonant to a desired frequency. This type of trap will show various series and parallel resonances through a great range of frequencies, so its behavior may be hard to predict. It has been used in at least one known design (fig. 3). Unfortunately, because of its very high L/C ratio it tends to develop very high voltages, causing corona-discharge problems in high-power applications. It also tends to be "lossy" because of the large amount of r.f. resistance inherent in large inductors, and it is very susceptible to detuning from nearby conducting objects.

Large-value components, whether they are inductors or capacitors, are bulky and heavy, and their relative electrical values affect the efficiency of tuned circuits in different ways. When the L/C ratio is high, the "Q" of the circuit tends to be low, because most of the losses are due to the resistance in the coil. This, however, provides a greater bandwidth. On the other hand, if the L/C ratio is low, the "Q" factor or efficiency of the circuit is high, and then its bandwidth is less. Therefore, a compromise has to be found which will give the most desirable characteristics both mechanically and electrically. The most popular inductors used with traps in multiband wire antennas are the air-core space-wound coils with a relatively large diameter. Their inductance should be such that they resonate at the desired frequency with about 1 to 2.5 pF per meter of wavelength. Beam antennas and verticals use shielded, grooved coil forms which are difficult to make and rather expensive. They work on the same

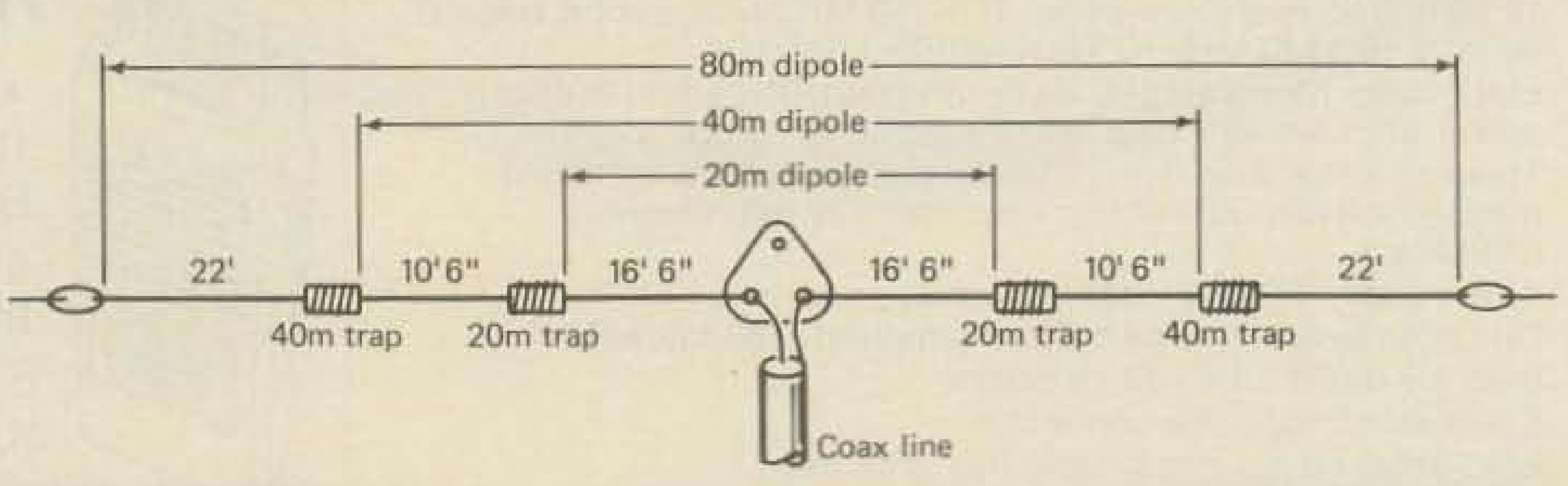

Fig. 2– A typical multiband trap antenna.

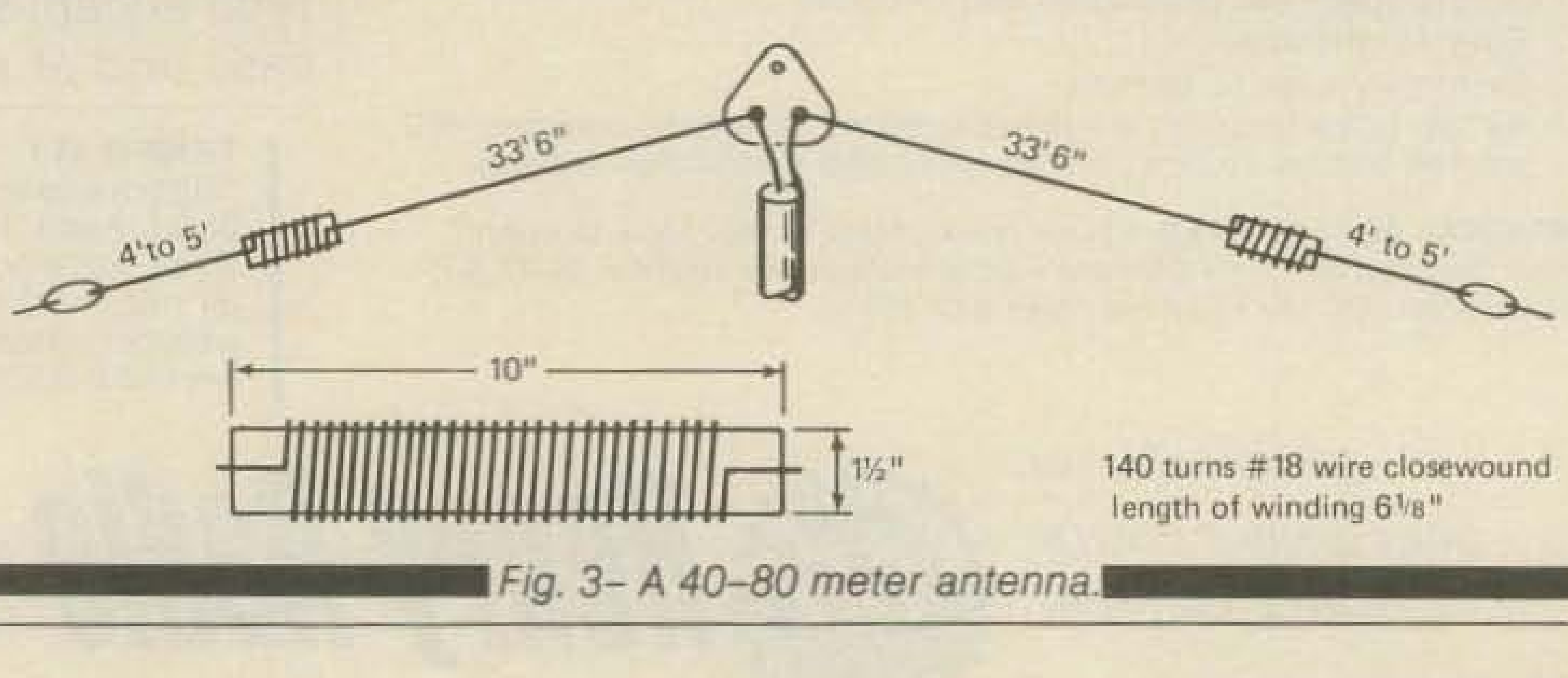

Fig. 3– A 40–80 meter antenna.

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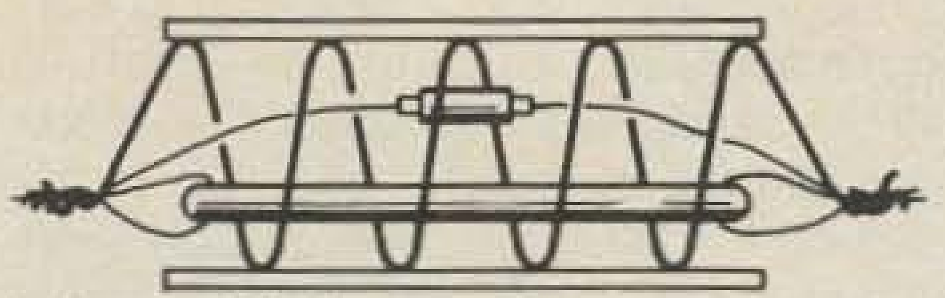
*1445 W. Saint Francis, Brownsville, TX 78520



Inductance 8.2µH
Capacitance 60pF (5Kv or more)
Resonance frequency approximately 7.15MHz
For 20m use half of the values given for C and L

Fig. 4– A "classic" trap using a transmitting ceramic capacitor and machine-wound commercial inductors. Egg-type insulators are not recommended; use long insulators for this purpose.

principle as other traps and are very sturdy and mechanically stable, but their construction is beyond the scope of this article. Some of the radio handbooks, however, describe the construction of similar traps which can be used in those applications.

Perhaps the easiest way to design a trap is to start with the capacitor, since this can be purchased or made to the exact value desired. The best capacitor seems to be the ceramic NPO transmitting type, sometimes called the "doorknob" type because of its shape. For up to 1 kw the voltage rating should be no less than 5 kv. For 200 watts or less a rating of 2.5 kv is suitable. These ratings will provide at least a 100 percent safety factor. Receiving-type capacitors should not be used even if their voltage rating is appropriate, because they do not have a good current-handling capability and they may not stand up in use, except perhaps with very low power. Transmitting mica capacitors are also suitable, but they are usually heavier and more vulnerable to the environment.

Fig. 4 shows a classic trap using a ceramic capacitor and an air-core inductor. The values given are for the 40 meter band. The next best choice is the coaxial cable capacitor. This is not only cheaper than most transmitting-type capacitors, but it has the advantage that it can be trimmed to an exact value. However, after the trap is built, the ends should be sealed to avoid changes due to humidity. The size can be calculated by the formula given in the appendix. It is always wise to start with a piece a little longer than necessary and then trim a quarter of an inch at a time until resonance is achieved at mid-band. Fig. 5 shows the recommended way to build a trap using a coaxial cable capacitor. RG58-type cable can be used for powers up to 200 watts or so; for higher powers RG8 should be used. As shown in fig. 5, the cable should be clamped or strapped to the antenna wire. Part of it, however, can be slipped inside the coil form. It is not a good idea to let the coax hang from the coil, since the wind will make it sway, and eventually it will break away.

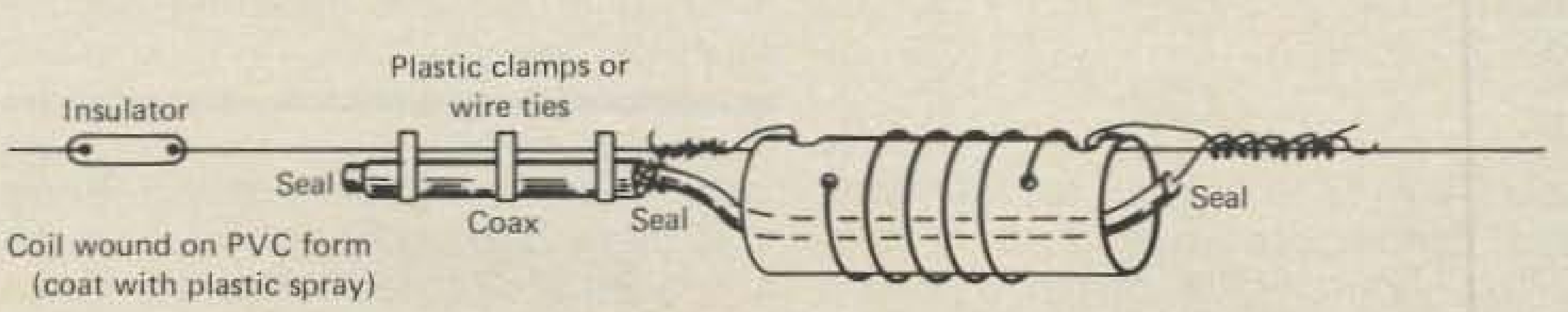

Plastic clamps or wire ties
Insulator
Seal
Coax
Seal
Seal
Coil wound on PVC form (coat with plastic spray)

Fig. 5– A trap tuned with a coaxial cable capacitor.

Another way of building a suitable capacitor is by using a double-sided, copper-clad, fiberglass printed circuit board. A sample (preferably a square or rectangle) of known area should be measured with an accurate capacitance meter, and the capacitance per square inch should be determined. The required area in inches can then be obtained easily by dividing the required capacitance by the pF per inch, which was previously determined. Of course, the shape of the capacitor is unimportant as long as the area (and the capacitance) are correct. Measurements on a 3/64 inch (1 mm) thick pc board have been determined to have about 20 pF per square inch.

No voltage rating is available, but a set of traps using this construction has been used with 100 watts without any problems. It may be a good idea to bevel the board at least on one side to avoid corona discharge. Capacitors made this way are very lightweight and can easily be installed inside the coil form. They should be sprayed with a suitable plastic coating to help preserve them (see fig. 6).

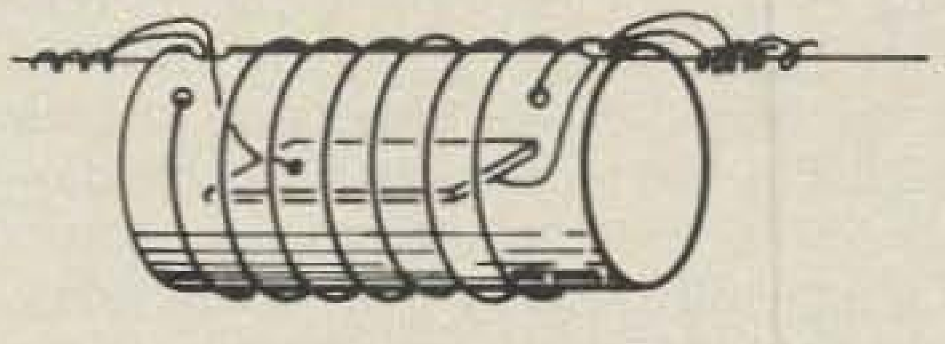
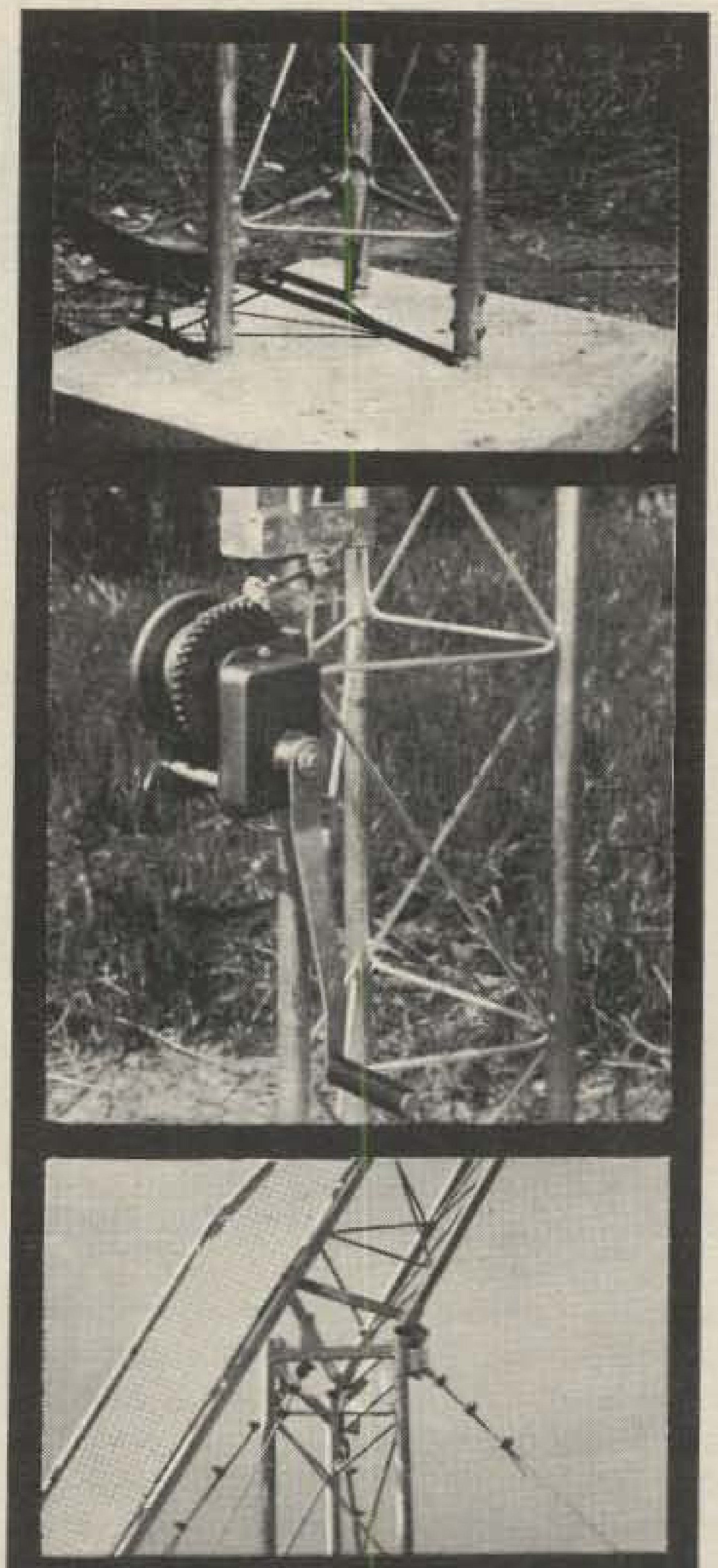


Fig. 6– A trap using a double-sided pc board capacitor.

Commercial "machine-wound" inductors can be used to build traps. They are made by several manufacturers and are not expensive. A coil diameter of at least 1½ inch should be used to keep losses down. The current amateur radio handbooks have extensive data on these inductors. Choose a stock that uses a No. 12 or 14 wire for best results. Cut it to the required length or slightly longer using the data in the handbook or the manufacturer's specifications. If the data is not available, the inductance can be calcu-



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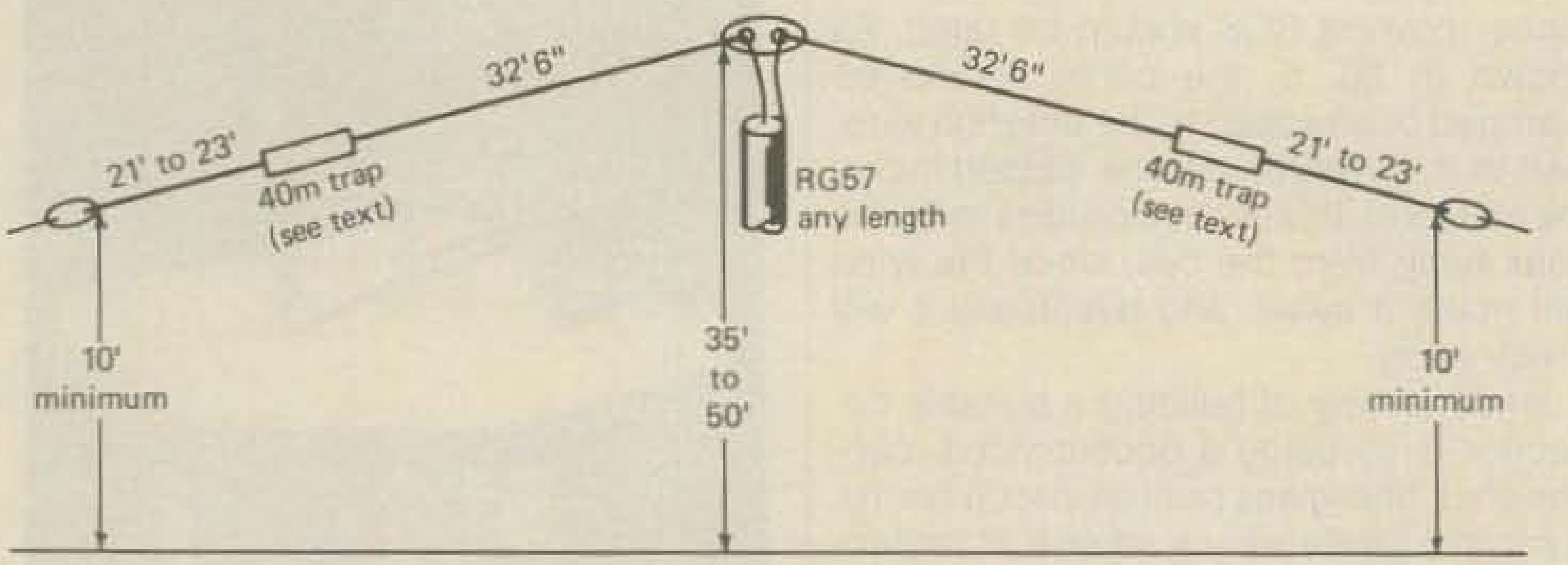

Fig. 7– An "all band" (10–80) trap antenna.

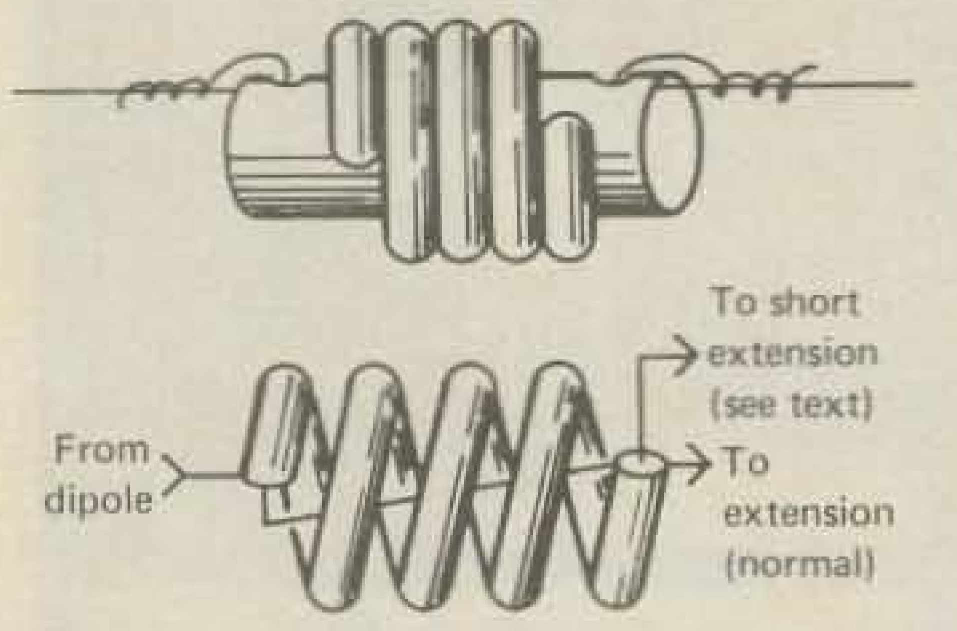

Fig. 8– A coaxial-cable trap.

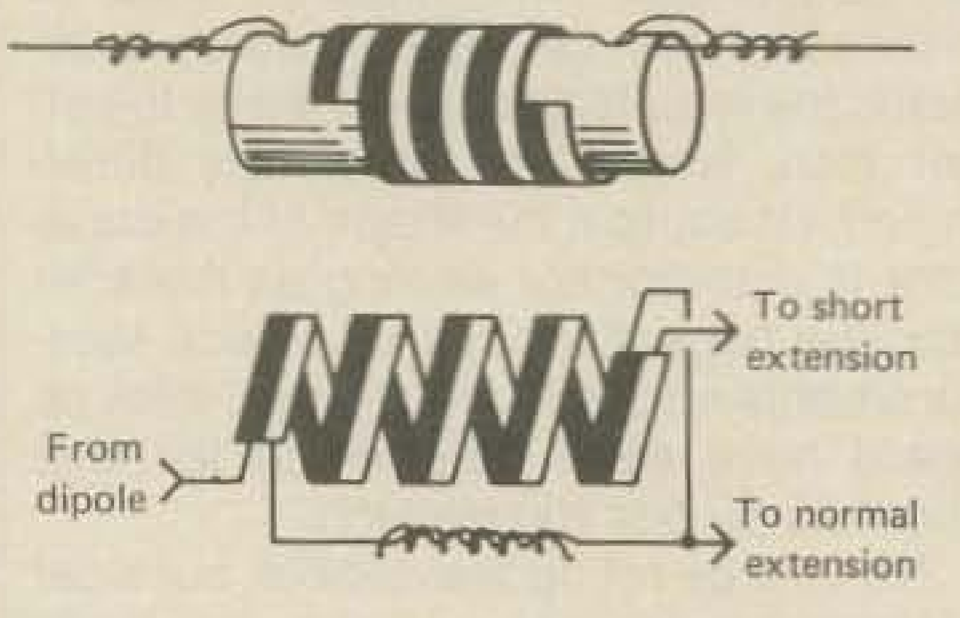

Fig. 9– A speaker-wire trap.

lated by means of the standard solenoid formula shown in the appendix. With this value and the capacitor value the theoretical resonance can easily be estimated. It should fall in about the middle of the desired band. However, when the trap is assembled, it can be checked with a grid-dip meter while disconnected from the antenna. Any adjustments then can be made to the inductor if ceramic capacitors are used, or to the capacitor if coaxial-cable or pc-board types are used.

Inductors can be homemade with relative ease. One of the simplest ways is to use a length of plastic tubing (water-pipe PVC will do a fairly good job). Cut the form 2 or 3 inches longer than required for the winding. A winding length of about 2½ inches should be about right for a 40 meter band trap. Using a 1½ inch diameter form and 21½ turns of No. 14 wire spaced about one wire diameter will create an inductance of about 8.2 microHenry. This coil used in conjunction with a 60 pF capacitor will resonate in the middle of the 40 meter band. Fig. 7 shows an antenna using two of these traps. The antenna is usable on all bands from 80 to 10 meters (except the WARC bands) because of the inherent harmonic relationships.

Band (meters)	Turns	Coax length (inches)	Winding Length (inches)
15	4¾	22.5	1
20	6½	30.5	1¼
30	8¾	41.2	1¾
40	12	56.5	2½

Table I– The winding data for coaxial traps. Tightly close-wound on a 1½ inch form RG58U solid dielectric, 28.5 pF/foot. Allow about 3 inches of extra coax for connection.

A new development that shows some merit is using coaxial cable simultaneously as inductor and capacitor.[1] This is accomplished by winding the coaxial cable on a suitable form and then connecting the inner conductor to the outer conductor at the opposite end of the coil. The outer conductor or shield can now be used as a trap and loading coil as with other types. These traps are easy to make when using small-size cables (RG58/59), but require considerable dexterity with the larger cables, which also produce rather bulky and heavy units. The L/C ratio of these coaxial traps is very small, so they tend to have a rather high "Q," causing the antenna to have a narrow bandwidth. Table I shows some representative values that can be used as guides in their construction. Fig. 8 shows how they are connected. Connecting the extension arm to the unused end of the inner conductor will cause a considerable reduction in the extension length (approximately equal to the length of the cable) with some loss of efficiency. A low-priced substitute, using the same principle, that can be used with powers of 100 watts or so is the bi-filar, clear-plastic "speaker wire."[2] It is very lightweight and flexible, so making traps with it results in a very simple operation. This wire has about one half the capacitance of RG58. Therefore, the L/C ratio is higher, showing better bandwidth, although presumably with higher losses—a normal trade-off in any case. Traps made with this material seem to stand up quite well outdoors. Winding data is shown in Table II and fig. 9.

Band (meters)	Turns	Wire length (inches)	Winding Length (inches)
10	4¾	22.5	⅞
15	5¾	27.2	1⅛
20	8	38.0	1½
30	11	52.0	2⅛
40	14½	68.5	2⅜

Table II– Winding data for speaker wire traps. Tightly close-wound on a 1½ inch diameter form. Radio Shack wire No. 278-1602 or equivalent, 13.5 pF/foot. Allow about 3 inches extra for connection.

Perhaps it is fair to say that any type of trap or loading coil will consume some power, reducing the overall efficiency. However, the reduction, whatever it may be, is certainly justified by the flexibility and convenience provided by these devices, allowing most of us to operate on the various available bands without having to own an antenna farm. CQ

Appendix

The approximate inductance of a single-layer air-core coil can be found by the following formula:

$$L \text{ (in microHenries)} = \frac{R^2N^2}{9R + 10S}$$

where *R* is the radius of the coil in inches, *N* is the number of turns, and *S* is the length of the winding in inches.

By transposing the terms, the required number of turns can be determined by this formula:

$$N = \frac{\sqrt{L(9R + 10S)}}{R}$$

Required capacitance for a given inductance and frequency can be found by

$$C = \frac{25330}{f^2L}$$

where *C* is in picoFarads, *f* is in MHz, and *L* is in microHenries.

If C is known and *L* is required, then

$$L = \frac{25330}{f^2C}$$

The length of a coaxial capacitor can be found by

$$l \text{ (in inches)} = \frac{C_{reg}12}{C_{coax}}$$

where *l* is the length of the coax in inches, *Ccoax* is the capacitance of the coax in pF/foot shown in the coax specs, and *Creg* is the capacitance required to resonate the inductor at the desired frequency.

The area of the double-sided board can be found by

$$A \text{ (in sq. inches)} = \frac{C_{reg}}{C_b}$$

where *Creg* is the required capacitance in pF, and *Cb* is the measured capacitance per square inch.

---

[1] *Johns, "Coaxial Cable Antenna Traps,* QST, *May 1981. O'Neil, "Trapping the Mysteries of Trapped Antennas,"* Ham Radio, *Oct. 1981.*

[2] *Radio Shack No. 278-1602.*

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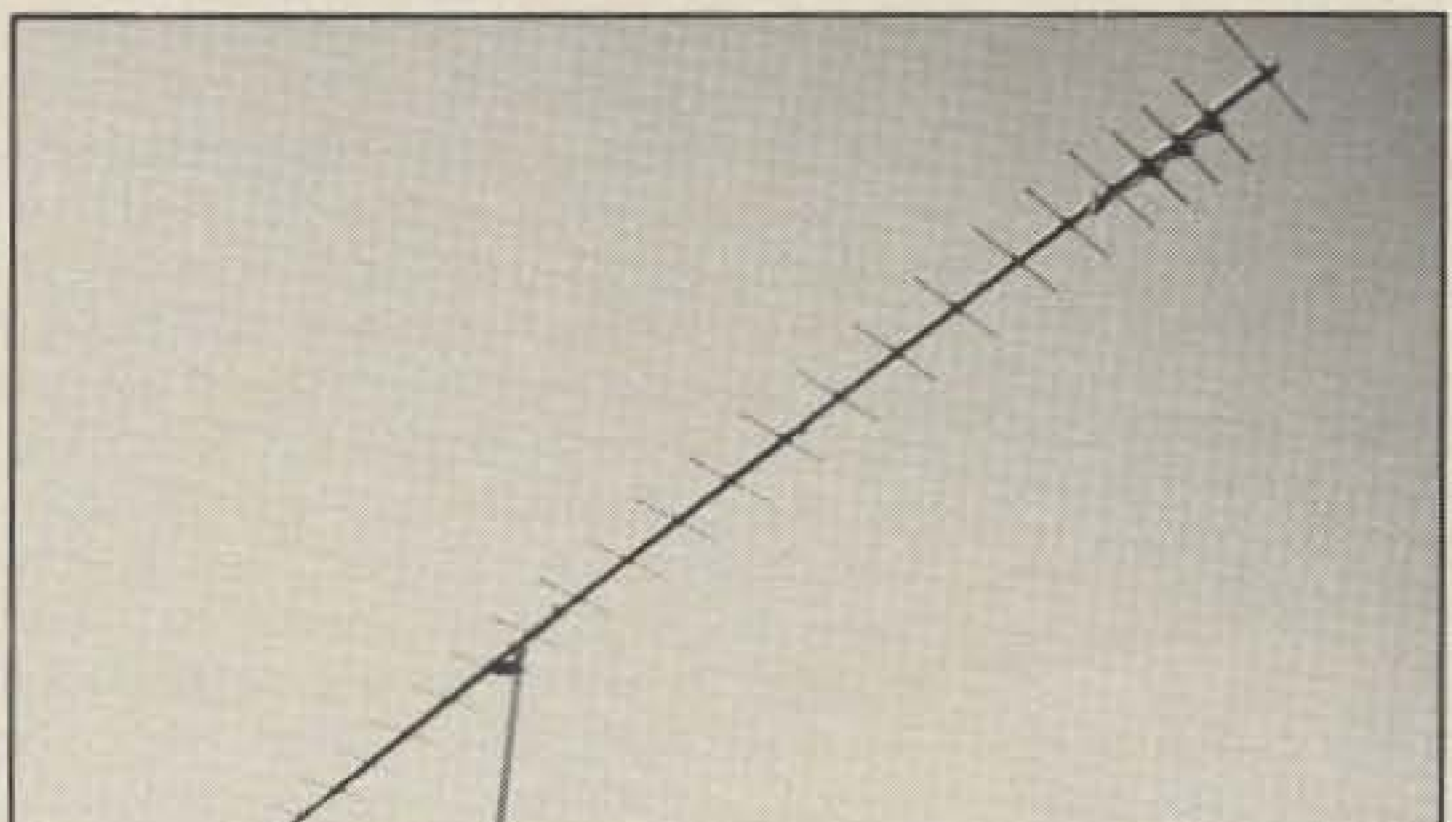
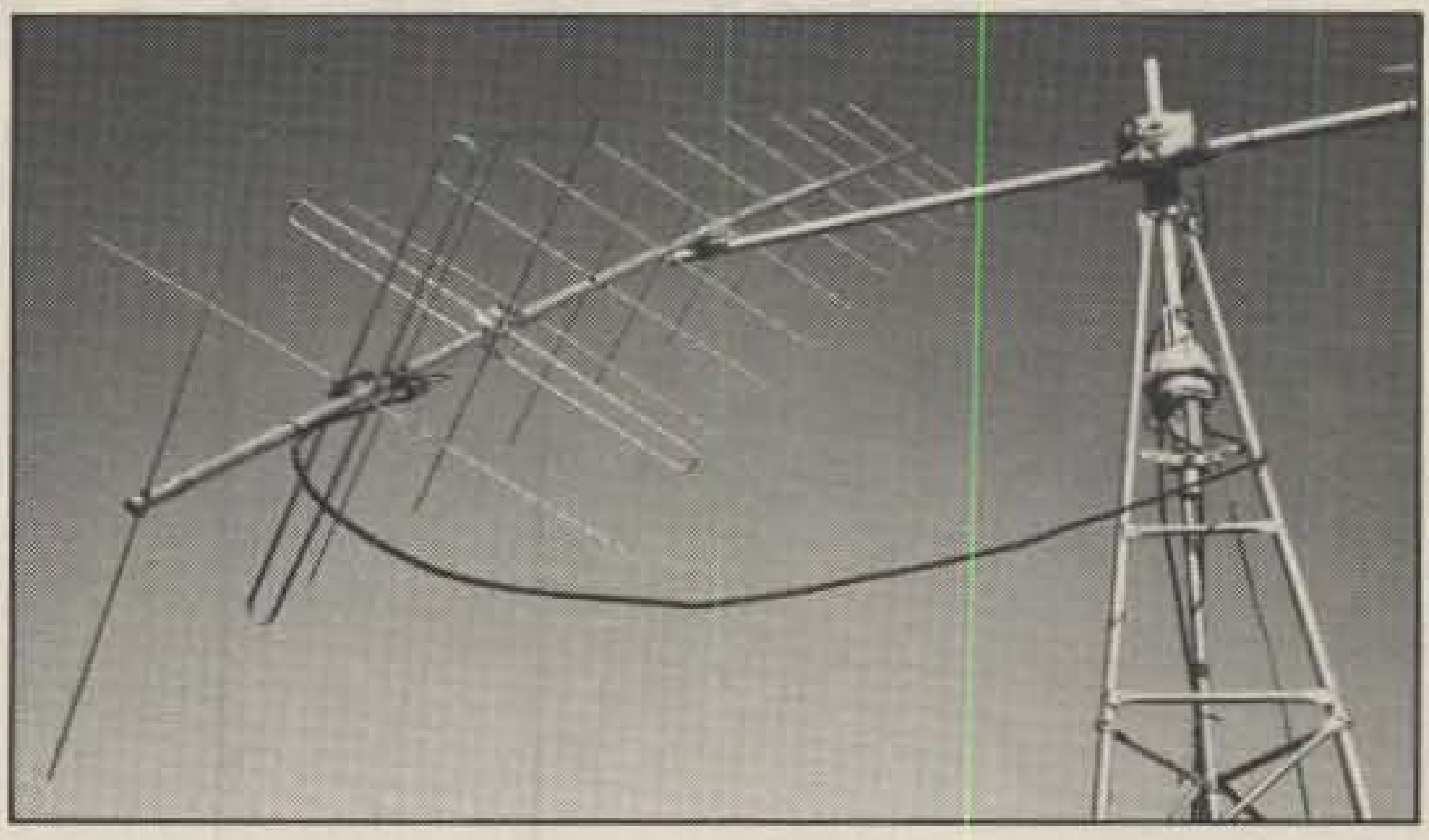


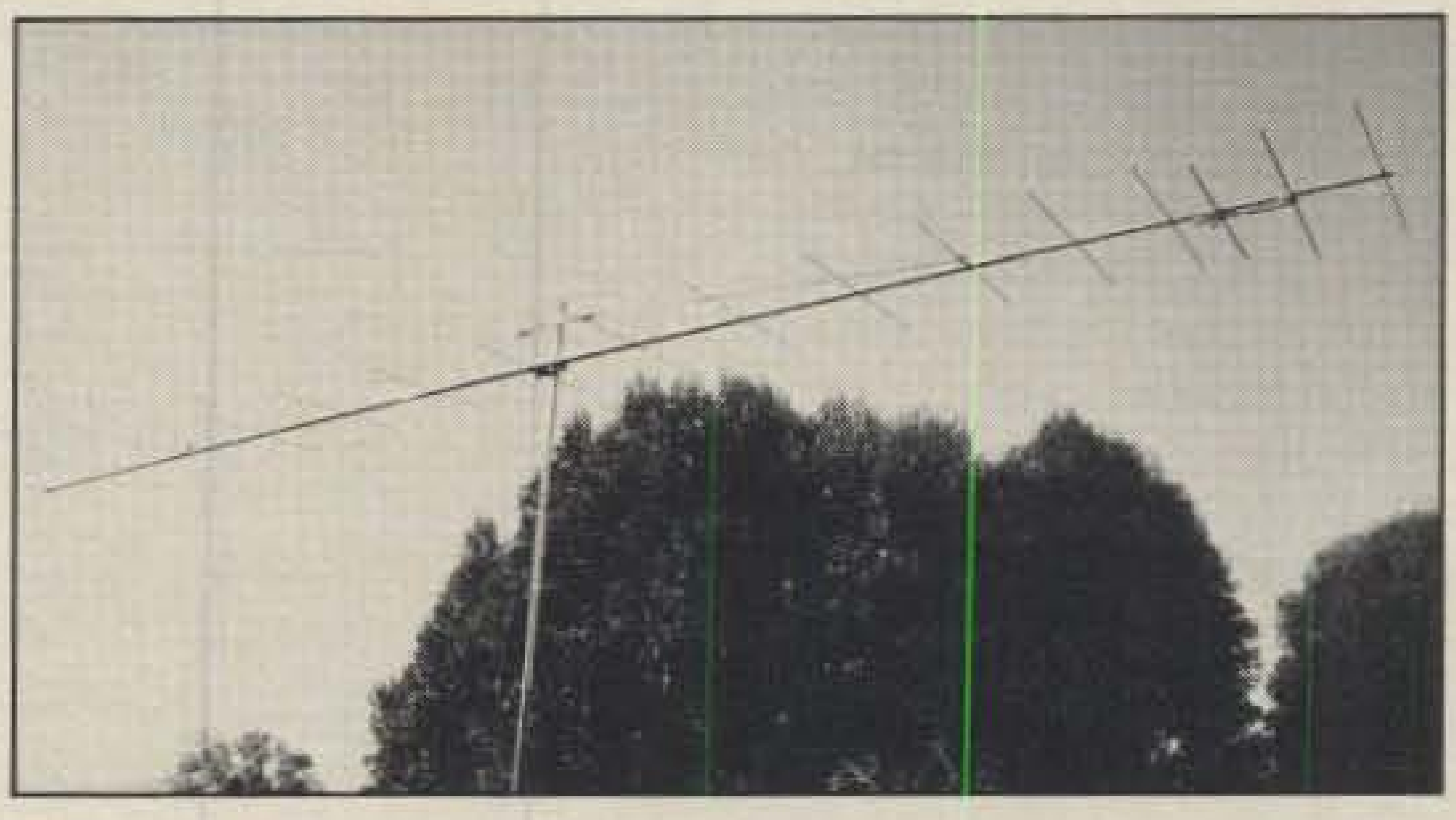
432-30LBX

BANDWIDTH	430–440 MHz
*GAIN	17.3 dBd
BEAMWIDTH	(E) 19°, (H) 20°
FEED IMP	50 ohms unbal.
BALUN	included
BOOM LENGTH	21 ft. 11 in.
F/B 20 dB	F/S 30 dB
VSWR	1.5:1
WINDLOAD	1.71 sq. ft. (max.)
TURNING RADIUS	12 ft. 4 in.
WT. (lbs.)	9 lbs.



2M-22C

BANDWIDTH	144–148 MHz
*GAIN	13 dBdc
BEAMWIDTH	(E) 32°, (H) 32°
FEED IMP	50 ohms unbal.
BALUN	(2) 4:1 coaxial
BOOM LENGTH	19 ft. 1 in. (tapered)
VSWR	1.5:1
WINDLOAD	1.85 sq. ft. max.
ELLIPTICITY	± 1.5 dB max.
CIRCULARITY SWITCHER	CS-3 included
WT. (lbs.)	11 lbs.



2M-16LBX

BANDWIDTH	144–146 MHz
*GAIN	(144 MHz) 14.5 dBd
BEAMWIDTH	(E) 26°, (H) 29°
FEED IMP	50 ohms unbal.
BALUN	4:1 coaxial, 2 KWPEP
BOOM LENGTH	28 ft. 1 in. (tapered)
VSWR	1.5:1
WINDLOAD	(H) 1.75 sq. ft. (V) 2.44 sq. ft. max.
WT. (lbs.)	10 lbs.
TURNING RADIUS	15 ft. 5 in.

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*To provide a more accurate and consistant gain figure, performance of this KLM antenna has been carefully measured and correlated in accordance with National Bureau of Standards Note #688. This gain figure may appear somewhat conservative when compared with others commonly found in conventional industry literature and based on older, less exacting rating methods.

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How you bend and feed a length of wire determines what you call what you have. W0WFO runs us through some loop antenna basics.

Dissecting Loop Antennas To Find Out What Makes Them Tick

BY ROY A. NESTE*, W0WFO

When I first saw the quad beam antenna, I was curious as to how it worked, but I never really bothered to figure it out. When the delta loop arrived, I became curious about its operation, as the quad and the delta loop seemed to be using the same system. That's when I realized that it actually was a takeoff on the old Lazy H of the 1930s, with the addition of a pair of reflectors. The Lazy H was merely two collinear half-waves in phase, stacked above two more collinear half-waves in phase with ½-wave spacing, resulting in a good DX antenna. The quad loop elements are really only one dipole stacked above another in phase, which results in less gain than the Lazy H, which has ¼-wave spacing and uses only one dipole above each other instead of stacked doubles. However, it does make a nice, compact stacked antenna. The delta loop uses the very same system in that it is made up of two dipoles stacked one above the other. The only difference is that the spacing between them is increased, and the dipoles have taken on a variety of shapes. If you look at each dipole as a straight wire electrically, you will see the "hidden" dipoles very clearly (see the dashed lines in figs. 3 and 4).

Antennas Using Two Half-Waves Stacked

The basic use of two half-waves is shown in fig. 1(A), the case of a full-wavelength antenna. When the current in dipole *X* flows from *A* to *B* and builds up a high voltage at *B*, the current in dipole *Y* flows from *C* to *B*, also building up a high voltage at *B*, as they are connected together at this point.

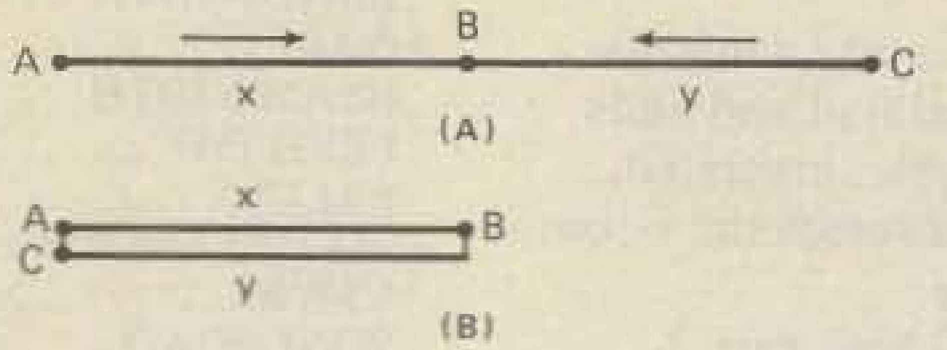


Fig. 1– (A) Full-wave dipole antenna. (B) Folded half-wave antenna.

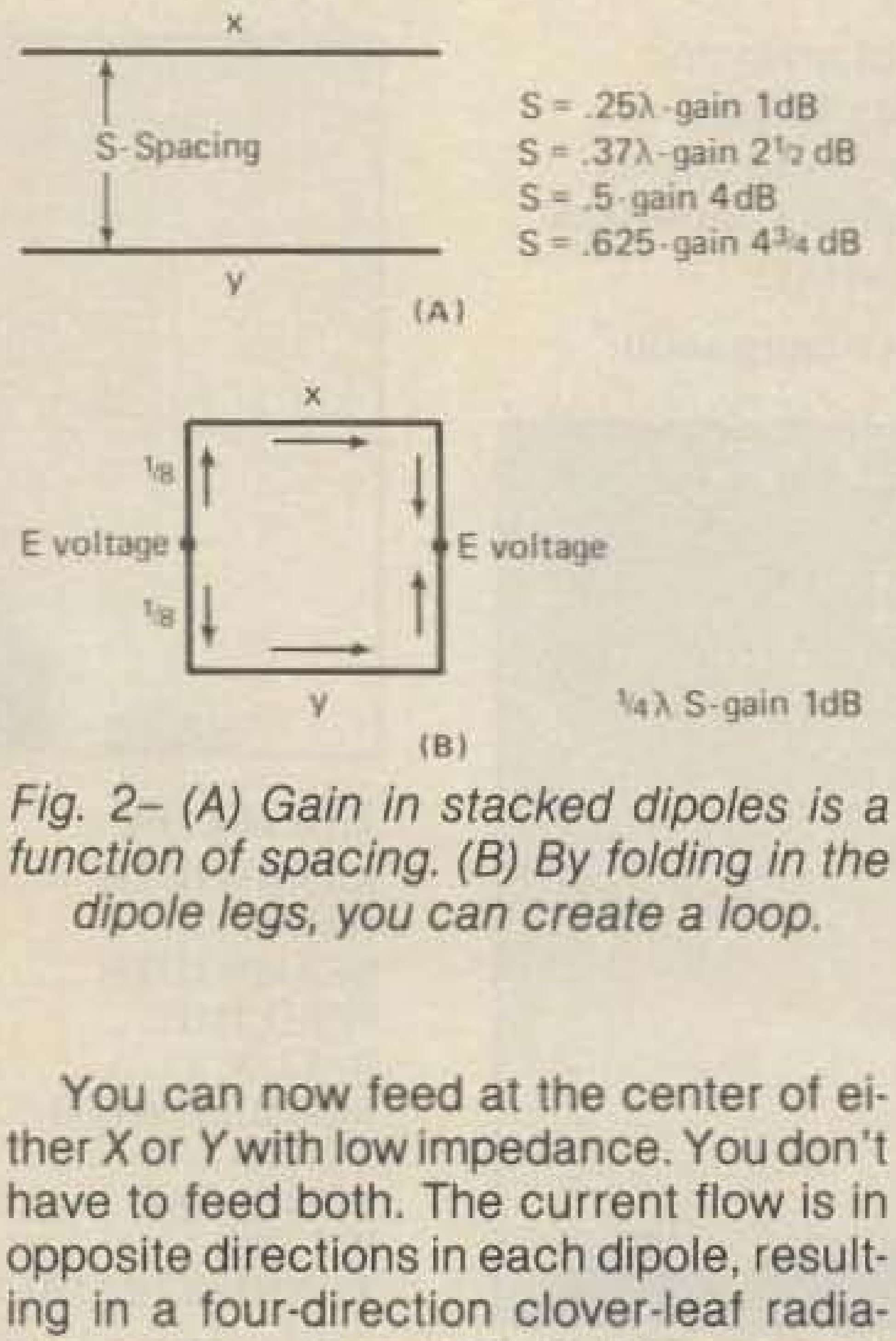


Fig. 2– (A) Gain in stacked dipoles is a function of spacing. (B) By folding in the dipole legs, you can create a loop.

You can now feed at the center of either *X* or *Y* with low impedance. You don't have to feed both. The current flow is in opposite directions in each dipole, resulting in a four-direction clover-leaf radiation pattern. Now let's fold the two dipoles at point *B* as shown in fig. 1(B), which then results in the current being in phase in both dipoles; now points *A* and *C* can be connected together. The antenna is now only the length of a half-wave, and the radiation pattern is the same as a single dipole and is called a folded dipole. In reality, however, it is two dipoles stacked with minimum spacing between them, resulting in no gain. Again, you can feed the center of either dipole instead of feeding them both.

Stacking Is the Name of the Game

As shown in the *ARRL Handbook*, if the spacing of two stacked dipoles in phase is made ¼ wavelength, the gain of the two increases to 1 dB. If they are spaced ⅜ wavelength, the gain is about 2½ dB. If they are spaced ½ wavelength, the gain is 4 dB. And if they are spaced ⅝ wavelength, the gain is about 4¾ dB—see fig. 2(A). Also, you gain considerably in lowering your angle of radiation, which is desirable for working DX. However, you have to have a proper harness or feedline to feed them, which can be awkward and messy.

There is another way to do it—see fig. 2(B). By taking ⅛ wavelength of each leg of the top dipole *X* and hanging them down, by hanging ⅛ wavelength of each leg of the bottom dipole *Y* and hanging them up, and by connecting them, you have the same situation as in fig. 1(B), but you have increased the spacing to ¼ wavelength for a 1 dB gain. You can then add a pair of parasitic elements to them to result in two 2-element Yagis spaced ¼ wavelength. This makes a set of two compact 2-element Yagis, which are stacked. You eliminated the bulky harness between them by using the loop design. You also increased the impedance at the feedpoint for a much more efficient feed. *Now the old question:* "Which is better, a 2-element quad or a 3-element Yagi?" The question really should be, "Which is better, two 2-element Yagis stacked at a ¼ wavelength spacing or a 3-element Yagi?"

For increased gain you can make the ⅛ bent lengths longer and increase the spacing for more gain, but there is a limit to how small the horizontal lengths may be cut. Too much cutting and your array starts to become lopsided in the case of a three-band beam.

---

*Box 108, Park River, ND 58270

Delta Loops

Delta loops are now a fashionable way of stacking dipoles for compactness and gain. Let's start with fig. 3(A). Here the *X* dipole has its arms out straight, but it bends in near the ends. The bottom dipole is bent in the form of a V. The dashed lines show the electrical figure of the two dipoles before bending them around. This delta loop is basically the same as fig. 1(B) and fig. 2(B) except the spacing between the centers of the two dipoles has been increased for extra gain. The low impedance is the center of either *X* or *Y* for coax feed, although the impedance is over 100 ohms, but you can use a 4:1 balun or a ¼-wave matching transformer of 75–100 ohm coax to match it. For horizontal radiation you can feed at the center of either *X* or *Y*, the bottom being the most convenient.

At fig. 3(B), by feeding low impedance at *X*, it then becomes the center of one dipole. It becomes a sloper dipole in a tilted V shape, and *Y* is a sloper with its ends bent to make a loop. Here you feed either at *X* or *Y*—the center of either dipole. Of course, for convenience you can make the top left corner the center and feed there at *X'* or the opposite at *Y'*. The impedance at the center of either dipole will now make a good match to 52 ohm coax.

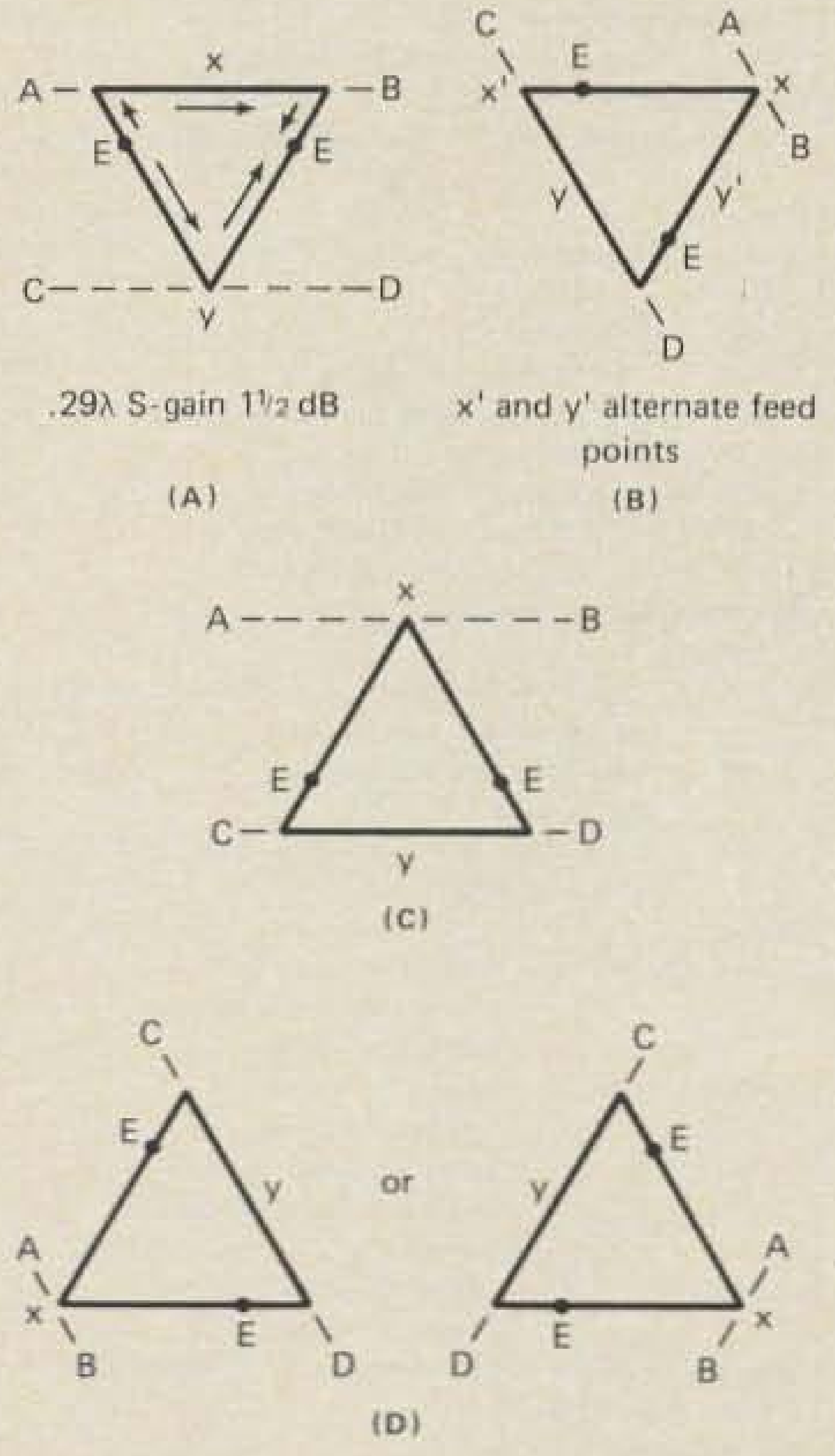


Fig. 3– (A) The configuration for a delta loop. (B) Low impedance, 52 ohms, feeding methods. (C) By changing the configuration, a balun is required. (D) Stacked slopers.

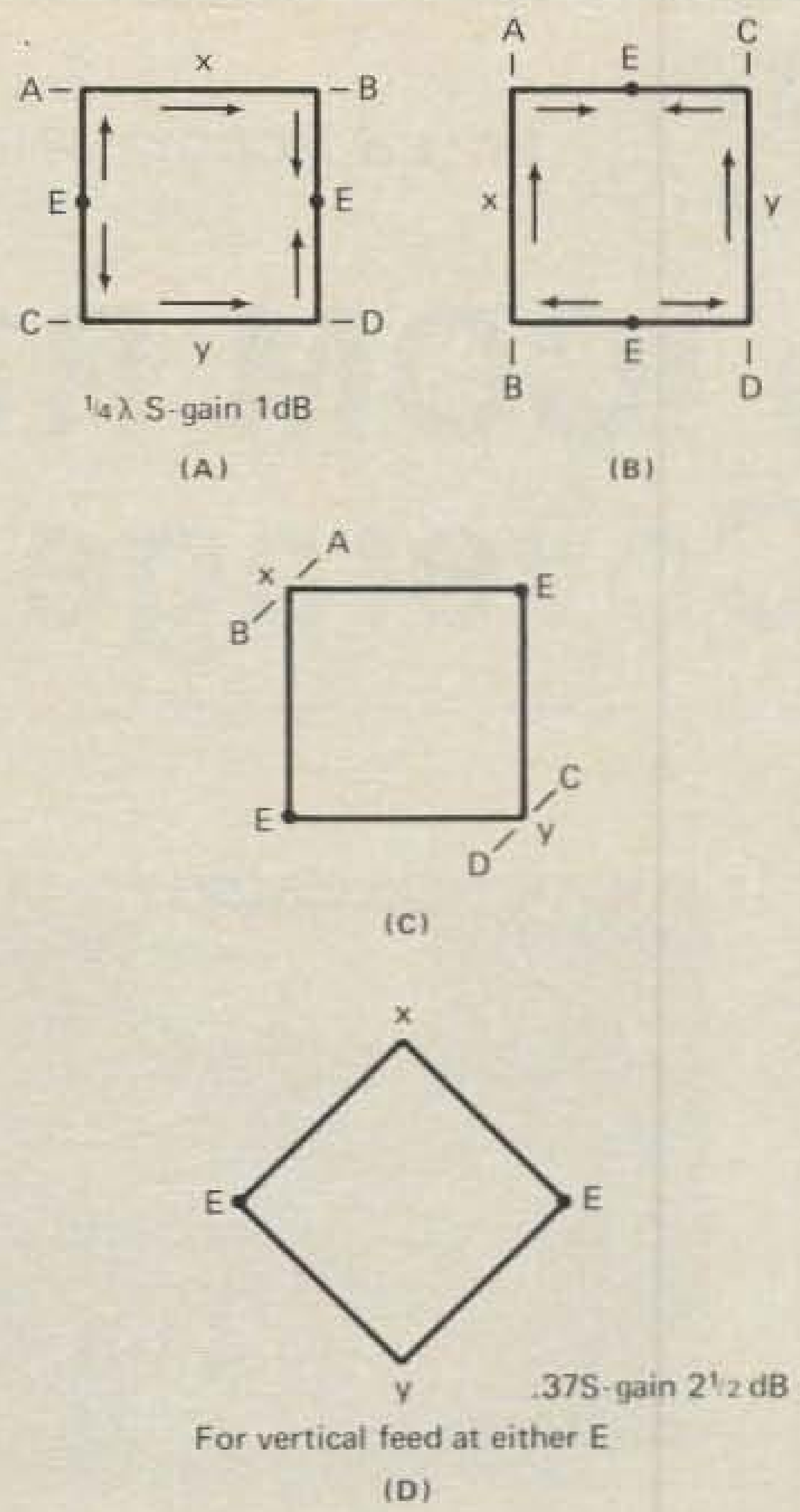


Fig. 4– (A) A quad with ¼-wave spacing. (B) By changing the feedpoint, it becomes vertically polarized. (C) A sloper configuration. (D) A diamond-shaped quad.

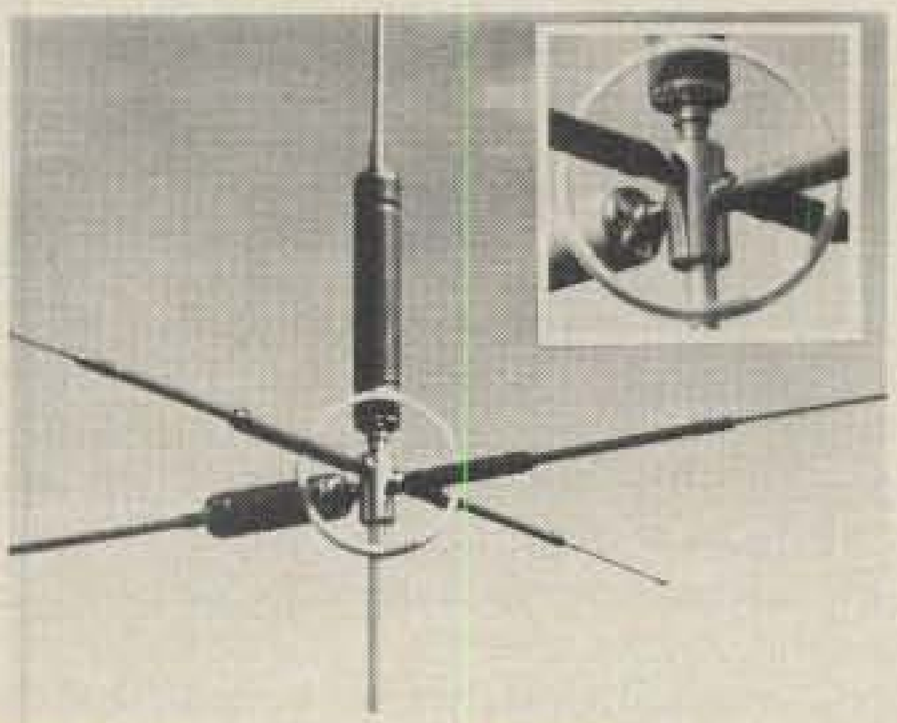
At fig. 3(C), dipole *X* is an inverted V, and dipole *Y* is a bent ½ wave. You can feed either at *X* or *Y*, but again you need a balun or ¼-wave transformer. On the other hand, in fig. 3(D) you can feed at *X* at the lower left bottom, or in the middle of the *Y* slant. Or, use the bottom right for *X* and the left slant for *Y* and feed either place. These places make stacked slopers of the dipoles and again give a good match at 52 ohms. It is to be noted that the delta slopers increase the spacing of the center of the dipoles to 0.29 wavelength for 1½ dB gain, compared to 1 dB for the quad shape.

Quad Designs

The quad versions can be used in a variety of ways. In fig. 4(A) we show the usual quad with ¼-wave spacing, and feed either *X* or *Y* for horizontal radiation. At (B) you feed at *X* or *Y* for vertical radiation. At (C) you can feed at opposite corners—either top left and lower right or top right and lower left— for slopers with currents also in phase for horizontal and vertical. Note that in (D) the quad is used in a diamond shape. By doing this you increase the spacing between the *X* and *Y* dipoles, which increases the gain. In the square version the spacing is ¼ wave for a 1 dB gain of the two driven elements alone without parasitic directors or reflectors, but the diamond shape increases the spacing to 0.37 wavelength for a gain of 2½ dB. The delta loop has a spacing of 0.29 wavelength for a gain of 1½ dB.

There is a question in the use of an equilateral delta loop (all three sides are equal), because the angle at the center of each dipole is only 60 degrees. For instance, an inverted V usually calls for at least a 90 degree angle because a smaller angle might tend to cause some cancellation. To offset this you would have to have one side longer than the other two equal sides. For 90 degrees the long side should be about 42 percent of the total length of the loop. For instance, for 40 meters the total length for the phone band would be about 139 feet, so the long side would be about 58'5" and the two other sides would be 40'3½" each. In this case if you want to feed at a top end, you should use a shape different from the delta. However, in practice the loops have been used at 60 degrees with good results. It is to be noted that in the diamond-shaped quad you not only get the angle of 90 degrees, but you also get the most spacing between each dipole for increased gain.

I have been using delta loops since Bill Orr came out with the English study on them about 8 years ago. For convenience I use the top as horizontal and feed the V at the bottom using 95 ohm ¼-wave coax to match 52 ohms. I string three of them (10, 15, 20) end for end for portable operation. Next to a beam, they are tops.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CQ REVIEWS:

BY LEW MCCOY*, W1ICP

The ICOM R71A General-Coverage Receiver

After using the ICOM IC-R70 receiver, it seemed the ultimate in receivers had been reached. However, the IC-R71A is better, if that is possible. Basically, the IC-R71A is a general-coverage receiver covering from 100 kHz through 30 MHz. How it does that takes a lot more words to tell, as you will see.

In years past we judged a receiver on sensitivity, stability, selectivity, ease of tuning, existing backlash, etc. When I sat down at my own station and tuned the IC-R71A, a whole new unbelievable world of radio opened up to me. Backlash? Zero, zilch, there was none at all, and I mean none! As to stability, I could find no drift whatsoever. Selectivity was the same story. The tuning knob and its associated readout were superb. Table I lists the specifications for the receiver. The one I tested easily met or surpassed all the specs. I was very impressed with the selectivity. In addition to what I would call normally good basic selectivity, the receiver has passband tuning plus a notch filter. When this is switched in, regardless of the receiving mode, the receiving passband can be narrowed up to 500 Hz. It is amazing how this serves to eliminate adjacent frequency heterodynes or interference.

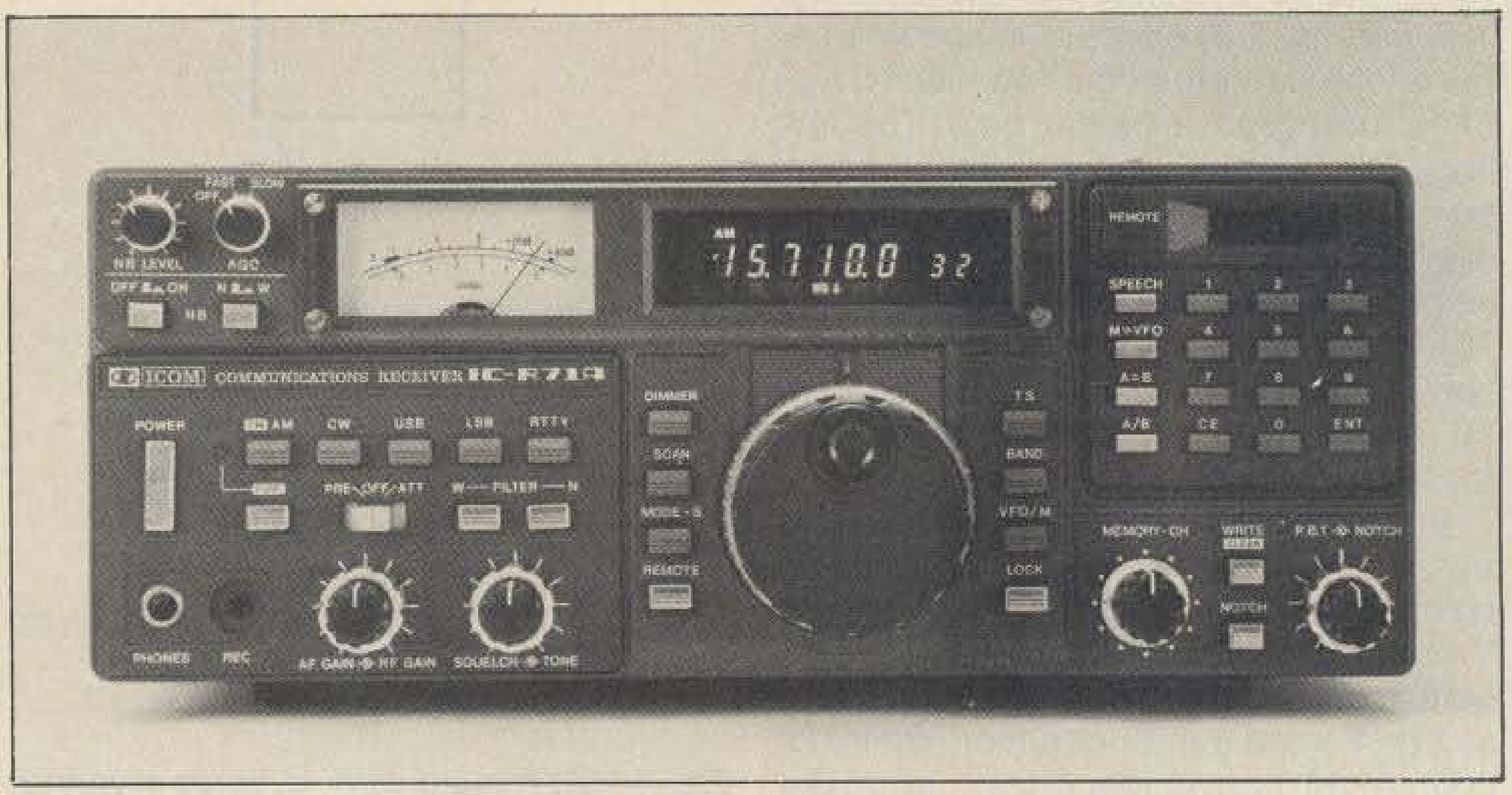
The Logic Unit

As with much of the new gear on the amateur market, the heart of this receiver is a central processing chip (CPU or microprocessor). This is in the logic section, and a block diagram is shown in fig. 1. The logic unit uses a CPU to treat data such as up/down signal detection control, the dial-lock control circuit, the tuning-rate select circuit, the band-switching circuits, code-converter circuits, and input/output control circuits. It is possible, via an option, to control the receiver via your personal computer. As the tuning dial is turned, clock signals are generated by a rotary encoder directly connected to the tuning knob. The up/down control circuit detects the direction of the knob and feeds the correct signal to the CPU. The CPU is an 8-bit processor.

The PLL Unit

There are two phase-locked loops used in the R71A—one for the first local oscillator, and another for a crystal oscillator used for reference frequency and a second local oscillator. The crystal oscillator operates at 30.72 MHz, and part of its output is multiplied by two and fed to the second mixer as the local oscillator signal. The other parts are divided by 10 kHz and 5 kHz as reference frequencies for the main and sub-loop.

The sub-loop oscillates from 115 to 119



The ICOM R71A receiver front with all the various controls.

GENERAL

Number of Semiconductors:

Transistors	90
FET	19
IC (Includes CPU)	47
Diodes	237

Frequency Coverage:
0.1MHz ~ 30MHz
(Australian Version: 2.0MHz ~ 30.0MHz)
(German Version: 0.15MHz ~ 26.1MHz)
Thirty 1MHz Segments

Frequency Control:
CPU based 10Hz step Digital PLL synthesizer with dual VFO system

Frequency Readout:
6 digit 100Hz readout.

Frequency Stability:
Less than 200Hz after switch on 1 min to 60 mins, and less than 30Hz after 1 hour. Less than 500Hz in the range of 0°C to +50°C

Power Supply Requirements:
117V or 235V ±10% 50 ~ 60Hz 30VA
(100V/200V/220V use requires internal modification)

Antenna Impedance:
50 ohms Unbalanced
(Single wire can be used on 0.1 ~ 1.6MHz)

Weight:
7.5 kg (16.5 lbs)

Dimensions:
111mm(H) x 286mm(W) x 276mm(D)
(4-3/8 inch x 11-1/4 inch x 10-7/8 inch)

RECEIVER

Receiving System:
Quadruple Conversion Superheterodyne with continuous Bandwidth Control
(F_3*: Triple Conversion Superheterodyne)

Receiving Mode:
A_1, A_3J (USB, LSB), F_1 (Output FSK audio signal), A_3, F_3*

IF Frequencies:

1st	70.4515MHz
2nd	9.0115MHz
3rd	455KHz
4th	9.0115MHz (except F_3*)

with continuous Bandwidth Control (except F_3*)

2nd IF Center Frequency:

SSB (A_3J) AM (A_3)	9.0115MHz
CW (A_1) RTTY (F_1)	9.0106MHz
FM* (F_3)	9.0100MHz

Sensitivity (when preamplifier is ON):

SSB, CW, RTTY	Less than 0.15 microvolts (0.1 ~ 1.6MHz : 1 microvolt) for 10dB S+N/N
AM	Less than 0.5 microvolts (0.1 ~ 1.6MHz : 3 microvolts)
FM*	Less than 0.3 microvolts for 12dB SINAD (1.6 ~ 30MHz)

Selectivity:

SSB, CW, RTTY	2.3KHz at –6dB (Adjustable to 500Hz min) 4.2KHz at –60dB
CW-N, RTTY-N	500Hz at –6dB 1.5KHz at –60dB
AM	6KHz at –6dB (Adjustable to 2.7KHz min) 15KHz at –50dB
FM*	15KHz at –6dB 25KHz at –60dB

Spurious Response Rejection Ratio:
More than 60dB

Audio Output:
More than 3 Watts

Audio Output Impedance:
8 ohms

*When optional FM unit is installed.

Table 1– Specifications for the R71A receiver.

**Technical Consultant, CQ, 200 Idaho St., Silver City, NM 88061*

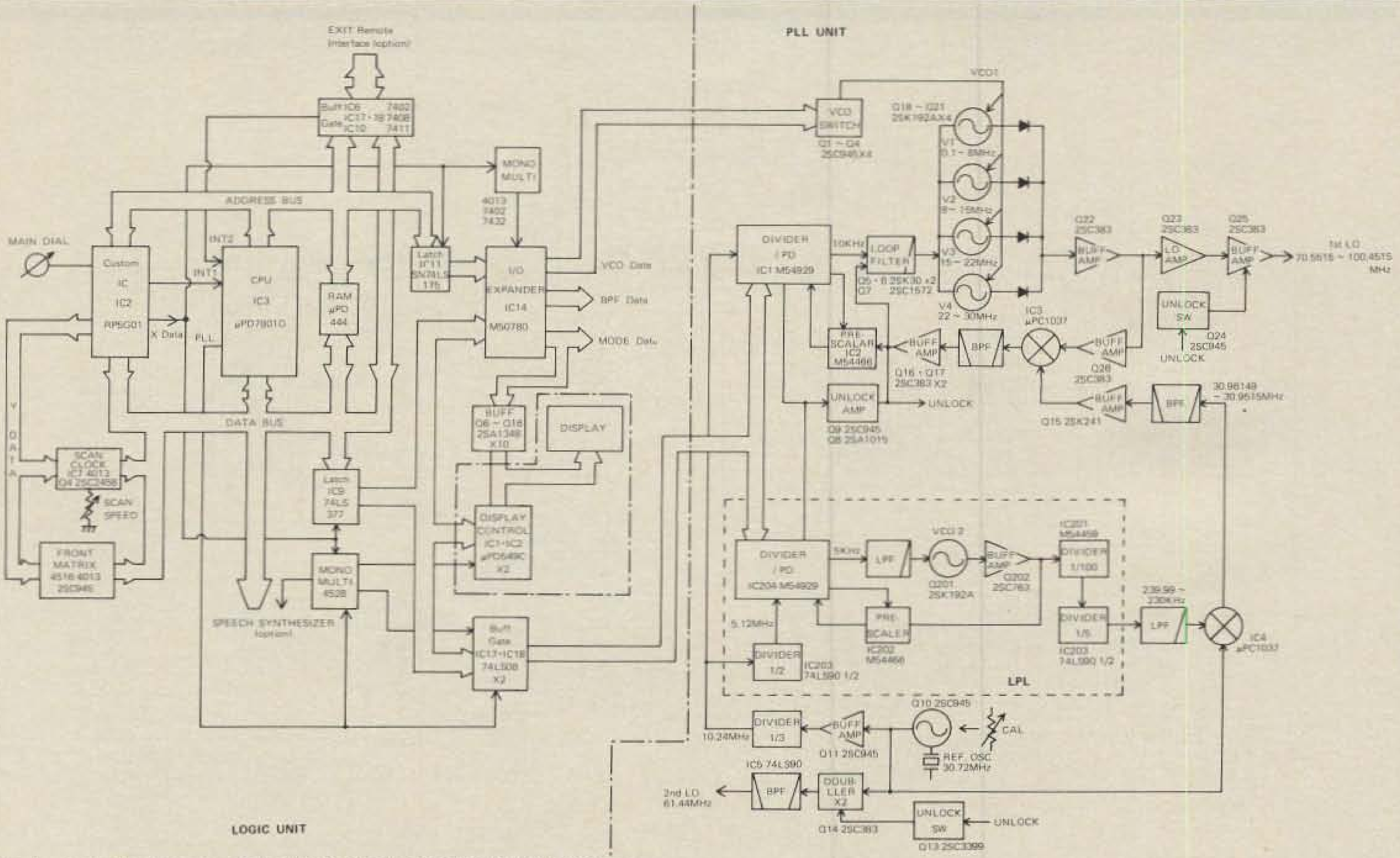

EXIT Remote
Interface (option)
Buff IC6 7402
Gate IC17・18 7408
IC10 7411
MONO MULTI
4013
7402
7432
ADDRESS BUS
MAIN DIAL
Custom IC IC2 RP5G01
INT2
INT1
CPU IC3 µPD7801G
X Data
PLL
RAM µPD 444
Latch IC11 SN74LS 175
I/O EXPANDER IC14 M50780
VCO Data
BPF Data
MODE Data
DATA BUS
Y DATA
SCAN CLOCK IC7 4013 Q4 2SC2458
SCAN SPEED
FRONT MATRIX 4516 4013 2SC945
Latch IC9 74LS 377
MONO MULTI 4528
SPEECH SYNTHESIZER (option)
BUFF Q6 ~ Q16 2SA1348 X10
DISPLAY
DISPLAY CONTROL IC1・IC2 µPD549C X2
Buff Gate IC17・IC18 74LS08 X2
LOGIC UNIT
PLL UNIT
VCO1
VCO SWITCH
Q1 ~ Q4 2SC945X4
Q18 ~ Q21 2SK192AX4
V1 0.1 ~ 8MHz
V2 8 ~ 15MHz
V3 15 ~ 22MHz
V4 22 ~ 30MHz
DIVIDER / PD IC1 M54929
10KHz
LOOP FILTER
Q5・6 2SK30 x2
Q7 2SC1572
Q22 2SC383
BUFF AMP
Q23 2SC383
LO AMP
Q25 2SC383
BUFF AMP
1st LO 70.5515 ~ 100.4515 MHz
UNLOCK SW
Q24 2SC945
UNLOCK
IC3 µPC1037
PRE-SCALAR IC2 M54466
BUFF AMP
BPF
Q16・Q17 2SC383 X2
Q26 2SC383
UNLOCK AMP
UNLOCK
Q9 2SC945
Q8 2SA1015
Q15 2SK241
30.98149 ~ 30.9515MHz
VCO 2
DIVIDER / PD IC204 M54929
5KHz
LPF
Q201 2SK192A
Q202 2SC763
IC201 M54459
DIVIDER 1/100
PRE-SCALER
IC202 M54466
5.12MHz
DIVIDER 1/2
IC203 74LS90 1/2
DIVIDER 1/5
IC203 74LS90 1/2
239.99 ~ 230KHz
LPF
IC4 µPC1037
LPL
Q10 2SC945
CAL
REF. OSC 30.72MHz
DIVIDER 1/3
10.24MHz
Q11 2SC945
IC5 74LS90
2nd LO 61.44MHz
BPF
DOUBLLER X2
Q14 2SC383
UNLOCK SW
Q13 2SC3399

Fig. 1– A block diagram of the logic circuits of the R71A receiver.

MHz with 5 kHz steps. This signal is divided by 500 to obtain 230 to 239 kHz with 10 kHz steps. It is then mixed with the 30.72 MHz crystal oscillator signal, and the result is fed to the mixer of the main loop as an oscillator output signal. The main loop puts out 70.55 MHz to 100.45 MHz as the first local oscillator of the receiver, with 10 Hz steps, for the entire band. This loop has four v.c.o.'s which divide the oscillator frequency range into various frequency segments ranging from 70.55 MHz to 100.45 MHz to improve the C/N (carrier/noise) ratio.

R.F. Unit

A block diagram of the r.f. circuitry/main unit circuitry is shown in fig. 2. The r.f. unit is composed of a bandpass filter for each band, a preamplifier, an attenuator, a first mixer, and first i.f. amplifier. The signal from the antenna passes through the appropriate bandpass filter and then through the preamplifier, if desired.

The preamplifier is rated at about 10 dB gain by ICOM, although the one I tested was more like 15 dB gain. If on the other hand you wish to attenuate the signal, the **PRE/ATT** switch is put in the **ATT** position and the signal is attenuated 20 dB. When the **PRE/ATT** switch is put in the off position, the signal is fed directly to the first mixer. The first mixer is a double-balanced mixer (DBM) in which the signal is mixed with the first local oscillator signal from the PLL unit, becoming a 70 MHz signal, which then is passed through a pair of monolithic filters and on to the second mixer in the main unit through the first i.f. amplifier.

At this point, I would like to make a few comments. I did side-by-side comparisons of the R71A and the last of one of the most expensive tube-type receivers (without mentioning names, this was the receiver everyone wanted in those days). In any event, I have been particularly "high" on this tube receiver because it has just about the best stability and selectivity anyone could find, but it is an amateur-bands-only unit. There is absolutely no doubt in my mind that the R71A is the better performer, and by a wide margin! I have always felt that the sensitivity on the tube receiver is just about as good as one can expect. On this point there wasn't much difference between the two receivers. However, as to selectivity, and I had all the filters in the tube job, the R71A with its filters and passband tuning literally ran rings around the tube-type.

The Main Unit

Getting back to the circuit description, the main unit has the second mixer; a crystal filter for s.s.b., a.m., and c.w. (option); i.f. passband tuning circuits; b.f.o.; the s.s.b., a.m. detector; and i.f. amplifiers. In the second mixer—also a double-balanced mixer—the signal is mixed with the 61 MHz signal from the second oscillator from the PLL unit. A 9 MHz signal is obtained and sent to the i.f. circuitry.

The R71A also contains a noise blanker, which consists of a noise amplifier, a noise detector, a pulse amplifier, and an a.g.c. circuit which blocks the noise pulses at the i.f. when noise is present. The signal from the second mixer is fed to the crystal filter through an amplifier. Next the signal goes to the i.f. amplifier and then to the passband tuning circuit, which is composed of two mixers, 455 kHz ceramic filters, and the v.x.o. circuit. When the passband tuning is turned on, the v.x.o. frequency can be changed ± 1.8 kHz (± 3.3 kHz in a.m.). The circuit makes a choice of which frequencies will pass electronically through the ceramic filter.

After this, the signal is sent to the product detector, the squelch control (the R71A has one), and the audio attenuator. In the case of a.m. the signal goes to the a.m. detector, then to an audio amplifier, the squelch control, and the attenuator. The audio signal from the attenuator is then applied to a high-performance low-distortion audio power amplifier and then to the speaker.

The b.f.o. has two crystal units—one for u.s.b. and the other for l.s.b., c.w., and RTTY. The oscillation frequency is shifted to an appropriate value for each mode.

Other Features

The photograph shows the many controls on the R71A. The frequency display is a luminescent display tube that provides a 6-digit, 100 Hz readout. Just above the numerical readout is shown the mode of operation. As the mode switch is changed, the readout shows **FM**, **AM**, **CW**, **USB**, **LSB**, or **RTTY**. Also, the memory channels in use is shown. In addition, **SIG** shows if the squelch is open and **SCAN** show the receiver is in the scan mode. The selected v.f.o. is shown as **VFO A** or **VFO B**. Last, there is a display **Tune**, which shows that the set is tuned to an incoming f.m. signal to within 1 kHz on the f.m. mode.

The well-lighted meter displays S1 through S0 and S9 to S0 + 40 dB. There is also a linear scale in five equal divisions. (I would have liked to see a scale in microvolts, as it would be handy for doing test work.) The noise blanker is controlled by the **Noise Blanker** switch plus the **Noise Blanker Level** and the **Noise Blanker Timing** controls. I might add that the noise blanker is excellent. Also, there is another control for fast or slow **AGC Timing**.

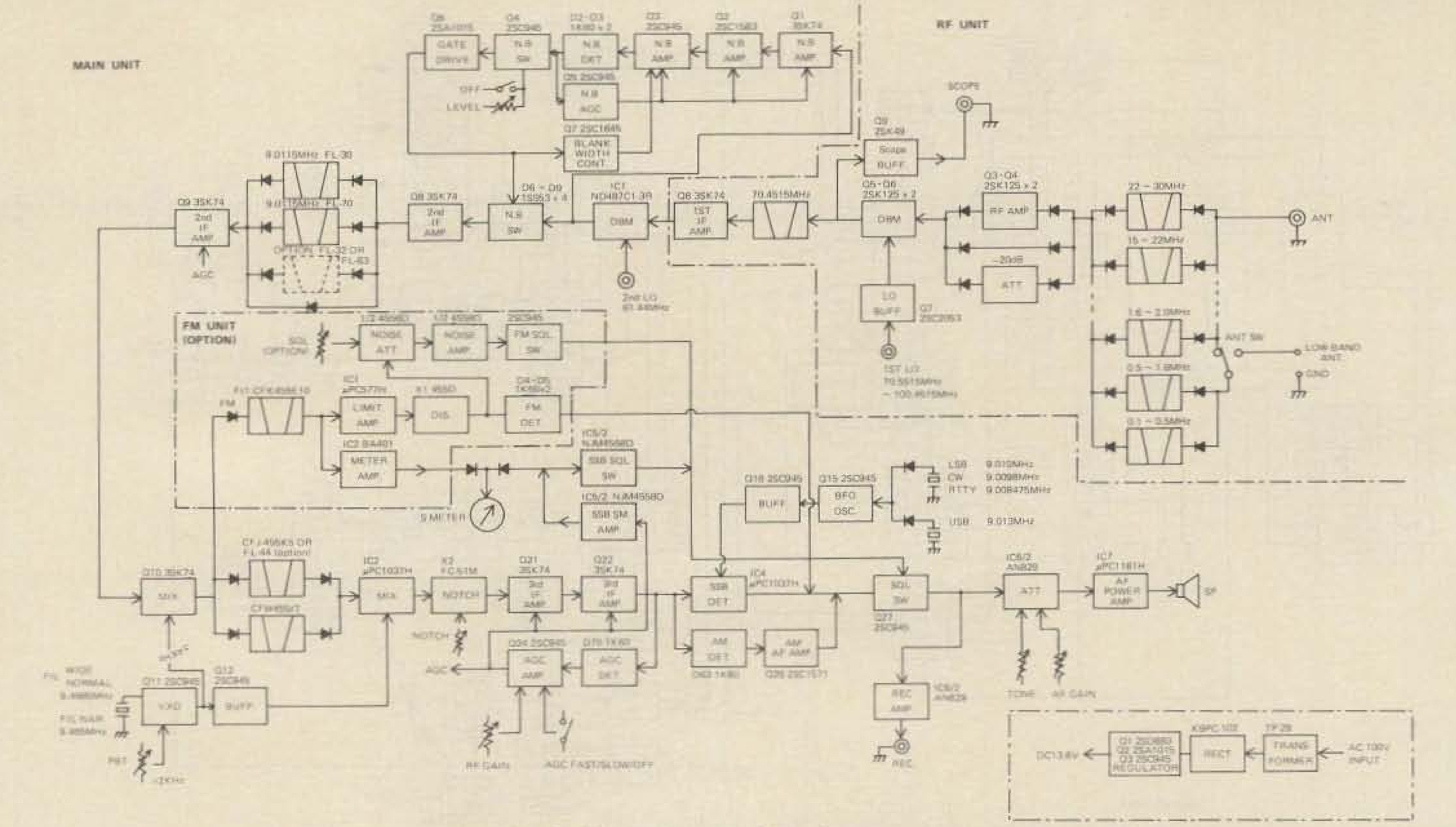

MAIN UNIT
RF UNIT
GATE DRIVE
N.B SW
N.B DET
N.B AMP
N.B AGC
BLANK WIDTH CONT.
OFF
LEVEL
9.0115MHz FL-30
OPTION FL-32 OR FL-63
Q9 3SK74
2nd IF AMP
AGC
Q8 3SK74
N.B SW
IC1
DBM
1ST IF AMP
70.4515MHz
2nd LO
SCOPE
Q9 2SK49
Scope BUFF
Q5-Q6 2SK125 x 2
DBM
Q3-Q4 2SK125 x 2
RF AMP
-20dB
ATT
LO BUFF
Q7 2SC2053
1ST LO 70.5515MHz ~ 100.4515MHz
22 ~ 30MHz
15 ~ 22MHz
1.6 ~ 2.0MHz
0.5 ~ 1.6MHz
0.1 ~ 0.5MHz
ANT
ANT SW
LOW BAND ANT
GND
FM UNIT (OPTION)
SQL (OPTION)
NOISE ATT
NOISE AMP
FM SQL SW
FM
LIMIT AMP
DIS.
FM DET
METER AMP
SSB SQL SW
IC5/2 NJM4558D
SSB SM AMP
S METER
Q10 3SK74
MIX
CFJ455K5 OR FL-44 (option)
CFW455IT
IC2 µPC1037H
MIX
NOTCH
Q21 3SK74
3rd IF AMP
Q22 3SK74
3rd IF AMP
NOTCH
AGC
Q24 2SC945
AGC AMP
AGC DET
RF GAIN
AGC FAST/SLOW/OFF
Q11 2SC945
VXO
Q12 2SC945
BUFF
PBT
Q18 2SC945
BUFF
Q15 2SC945
BFO OSC
LSB 9.010MHz
CW 9.0098MHz
RTTY 9.008475MHz
USB 9.013MHz
SSB DET
IC4 µPC1037H
AM DET
AM AF AMP
SQL SW
Q27 2SC945
IC6/2 AN829
ATT
IC7 µPC1181H
AF POWER AMP
SP
TONE
AF GAIN
REC AMP
REC
DC13.8V
Q1 2SD880
Q2 2SA1015
Q3 2SC945
REGULATOR
RECT
TRANS FORMER
AC 100V INPUT

Fig. 2– Block diagram of the r.f./main units.

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CIRCLE 38 ON READER SERVICE CARD

Memory Features

One of the big features of the R71A is its ability to store up to 32 different frequencies and recall them at the touch of a button (or scan them if desired). There is also an infrared controller that is available as an option whereby the memories can be controlled or scanned from a remote operating position. I didn't have this feature to review, but I assume you would have to be near the receiver (in the same room) to do such controlling. There is a remote-control indicator window just above the key pad where the memory channel would be displayed.

The desired frequency is entered via a keypad consisting of 10 numerical keys. Using the **Memory Channel Select** switch, a channel is chosen and then put into memory via the **Memory Write/Clear** button. It is possible to store 32 channels in this manner. These channels can be scanned by using the **Scan** button and the **Mode Selective Scan** switch. (It is possible to scan the entire receiver coverage if desired!)

Some More

There are a few more features of particular interest. The tuning knob is set up so that in one position of the **Tuning Rate** switch the frequencies or the readout is incremented in 10 Hz steps if the tuning knob is turned slowly. However, when the knob is rotated faster, the tuning increments in 50 Hz steps—a very nice feature. If you want a faster tuning rate, pushing in the **Tuning Rate** switch gives you 1 kHz increments.

Something I didn't mention earlier when discussing selectivity is that there is also an adjustable notch filter available. This can be used on conjunction with the other selectivity features to null out annoying heterodynes. There are also a tune control and a squelch control. There is a voice-synthesizer option available whereby the displayed frequency is read out in voice, which would be convenient for someone who is visually handicapped. As a matter of fact, ICOM is making this option available with several pieces of equipment.

If you desire to use the R71A with a transmitter, there is a mute connection on the back of the receiver. You can also control a recorder via a terminal on the rear or obtain a scope output of the 70.4515 MHz i.f. signal from the receiver. Provision is made for an external speaker (there is a built-in speaker in the receiver).

Conclusions

As I said at the outset, I was extremely impressed by the R71A. It is one of the best receivers I have ever used. This unit easily met or surpassed all of the ICOM specs in my tests, so I am just about at a point where I am at a loss for words (that will be the day!). Incidentally, it is the same as or very similar to the general-coverage receivers used in the ICOM transceivers.

I don't know what can be coming next in receiver design, but possibly it will be a built-in spectrum analyzer that will show all bands at one time so you can quickly see what bands are open. Also, it is possible now to build in circuitry that will read out or translate c.w. or RTTY into voice readout or something else equally as exotic. We'll just have to wait and see.

The options available are an f.m. unit, the FL-32 or FL-63 narrow c.w. filter, the FL-44A 455 kHz s.s.b. filter, the IC-EX310 voice synthesizer, a high-stability crystal marker unit, the CR-65, and last the IC-EX309 interface for use with a personal computer. The ICOM R71A's list price is $799, and it is manufactured by ICOM International, Osaka, Japan, and distributed by ICOM America, Inc., 2112 116th Ave. NE, Bellevue, WA 98004. CQ

FREE MFJ SOFTWARE

Free MFJ RTTY/ASCII/CW software for VIC-20 or C-64 with purchase of MFJ-1224, MFJ-1225 or MFJ-1228 from MFJ. Send/receive Baudot, ASCII, CW. Type ahead buffer. 24 hour clock. Supports VIC printer. Menu Driven. MFJ-1224/1225 cable. On tape. Available separately for $29.95.

RTTY/ASCII/AMTOR/CW INTERFACE CARTRIDGE FOR VIC-20/C-64

MFJ-1228 **$69 95**

FREE MFJ RTTY/ASCII/CW Software

INCLUDES MFJ-1228, SOFTWARE ON TAPE. ADD VIC-20 OR C-64 AND RIG TO ENJOY COMPUTERIZED RTTY/ASCII/CW. ORDER MFJ-1228/MFJ-1264 FOR VIC-20, MFJ-1228/MFJ-1265 FOR C-64.

Most versatile RTTY/ ASCII/AMTOR/CW interface cartridge available for VIC-20 and Commodore 64. Gives you more features, more performance, more value for your money than any other interface cartridge available.

Same interface cartridge works for both VIC-20 and Commodore 64. Plugs into user's port.

Choose from wide variety of RTTY/ASCII/CW, even AMTOR software. Not married to one on-board software package. Use MFJ, Kantronics, AEA plus other software cartridge, tape or disk.

850 Hz and 170 Hz shifts on receive **and** transmit.

Has mark and space outputs for scope tuning.

Normal/Reverse switch eliminates retuning.

True dual channel mark and space active filters and automatic threshold correction gives good copy when one tone is obliterated by QRM or selective fading.

Easy, positive tuning with twin LED indicators.

Narrow 800 Hz active CW filter. Automatic PTT.

Exar 2206 sine generator for AFSK output.

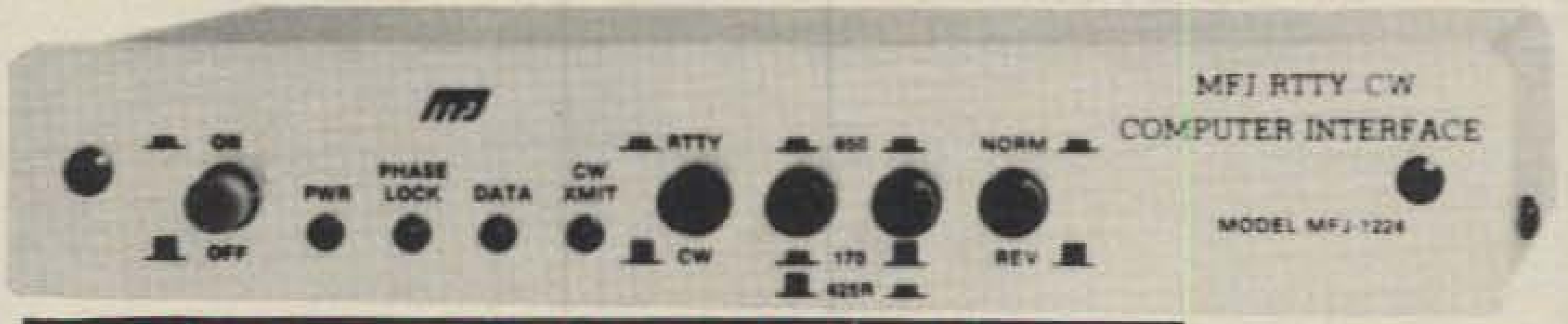
Shielded XCVR AFSK/PTT interface cable provided. Plus or minus CW keyed output. FSK out.

Powered by computer (few ma.), no power adapter to buy or extra wire to dangle or pick up/radiate RFI.

Glass epoxy PCB. Aluminum enclosure. 4½x4½x1".

UNIVERSAL RTTY/ASCII/AMTOR/CW COMPUTER INTERFACE

Lets you send and receive computerized RTTY/ASCII/AMTOR/CW. Copies all shifts and all speeds. Copies on both mark and space. Sharp 8 pole active filter for 170 Hz shift and CW. Plugs between your rig and VIC-20, Apple, TRS-80C, Atari, TI-99, Commodore 64 or other personal computers. Uses MFJ, Kantronics, AEA software and other RTTY/CW software.



FREE MFJ RTTY/ASCII/CW Software

COMPLETE PACKAGE INCLUDES MFJ-1224, SOFTWARE ON TAPE, CABLES. YOU NEED ONLY VIC-20 OR C-64 AND RIG TO ENJOY COMPUTERIZED RTTY/ASCII/CW. ORDER MFJ-1224/MFJ-1264 FOR VIC-20. MFJ-1224/MFJ-1265 FOR C-64.

MFJ-1224
$99 95

New MFJ-1224 RTTY/ASCII/AMTOR/CW Computer Interface lets you use your personal computer as a computerized full featured RTTY/ASCII/AMTOR/CW station for sending and receiving. Plugs between rig and VIC-20, Apple, TRS-80C, Atari, TI-99, Commodore 64 and most others.

Use MFJ software for VIC-20, Commodore 64 and Kantronics for Apple, TRS-80C, Atari, TI-99 and most other software for RTTY/ASCII/AMTOR/CW.

Easy, positive tuning with twin LED indicators.

Copy any shift (170,425,850 Hz and all other shifts) and any speed (5-100 WPM RTTY/CW and up to 300 baud ASCII).

Copies on both mark and space, not mark only or space only, to improve copy under adverse conditions.

Sharp 8 pole 170 Hz shift/CW active filter gives good copy under crowded, fading and weak signal conditions. Automatic noise limiter suppress static crashes for better copy.

Normal/Reverse switch eliminates retuning. +250 VDC loop output drives RTTY machine. Speaker jack.

Automatic tracking copies drifting signal.

Exar 2206 sine generator gives phase continuous AFSK tones. Standard 2125 Hz mark and 2295/2975 Hz space. Microphone line: AFSK out, AFSK ground, PTT out and PTT ground.

FSK keying output. Plus and minus CW keying. CW transmit LED. External CW key jack.

Kantronics compatible socket.

Exclusive general purpose socket allows interfacing to nearly any personal computer with most appropriate software. Available TTL lines: RTTY demod out, CW demod out. CW-ID input, +5 VDC, ground. All signal lines are buffered and can be inverted using an internal DIP switch.

Use Galfo software with Apple, RAK with VIC-20, Kantronics with TRS-80C, TI-99, N4EU with TRS-80 III, IV. Some computers with some software may require some external components.

Metal cabinet. Brushed alum. front. 8x1¼x6 in. 12-15 VDC or 110 VAC with adapter, MFJ-1312, $9.95.

MFJ-1223, $29.95, RS-232 adapter for MFJ-1224.

UNIVERSAL SWL RECEIVE ONLY COMPUTER INTERFACE FOR RTTY/ASCII/AMTOR/CW

MFJ-1225
$69 95

FREE MFJ RTTY/ASCII/CW Software

TAPE AND CABLE FOR VIC-20 OR C-64. ORDER MFJ-1225/MFJ-1264 FOR VIC-20 OR MFJ-1225/MFJ-1265 FOR C-64.

Use your personal computer and communications receiver to receive commercial, military and amateur RTTY/ASCII/AMTOR/CW traffic.

Plugs between receiver and VIC-20, Apple, TRS-80C, Atari, TI-99, Commodore 64 and most other personal computers. Requires appropriate software.

Use MFJ, Kantronics, AEA and other RTTY/ASCII/AMTOR/CW software.

Copies all shifts and all speeds. Twin LED indicators makes tuning easy, positive. Normal/Reverse switch eliminates tuning for inverted RTTY. Speaker out jack. Includes cable to interface MFJ-1224 to VIC-20 or Commodore 64. 4½x1¼x4¼ inches. 12-15 VDC or 110 VAC with optional adapter, MFJ-1312, $9.95.

SUPER RTTY FILTER

MFJ-725
$39 95

MFJ COMPUTER INTERFACE FILTER

Super RTTY filter greatly improves copy under crowded, fading and weak signal conditions. Improves **any** RTTY receiving system. 8 pole bandpass active filter for 170 Hz shift (2125/2295 Hz mark/space). 200 or 400 Hz bandwidths. Automatic noise limiter. Audio in, speaker out jacks. On/off/bypass switch. "ON" LED. 12 VDC or 110 VAC with optional AC adapter, MFJ-1312, $9.95. 3x4x1 inch aluminum cabinet.

CW INTERFACE CARTRIDGE FOR VIC-20/C-64

$39 95
MFJ-1226

High performance CW interface cartridge. Gives excellent performance under weak, crowded, noisy conditions. Works for both VIC-20 and Commodore 64. Plugs into user's port.

4 pole 100 Hz bandwidth active filter. 800 Hz center frequency. 3 pole active lowpass post detection filter. Exclusive automatic tracking comparator.

Plus and minus CW keying. Audio in, speaker out jacks. Powered by computer.

Includes Basic listing of CW transmit/receive program. Available on cassette tape, MFJ-1252 (VIC-20) or MFJ-1253 (C-64), $4.95 and on software cartridge, MFJ-1254 (VIC-20) or MFJ-1255 (C-64), $19.95.

You can also use Kantronics, AEA other software.

Also copy RTTY with single tone detection.

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cam actuated, true zero insertion – tin plated solder tail pins – capable of being plugged into dip sockets, including wire wrap.

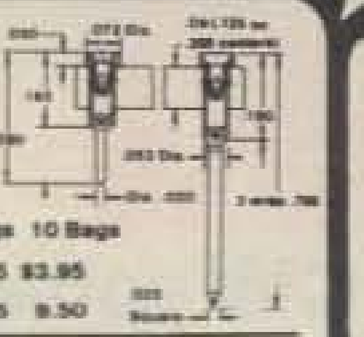
Stock No.	No. of Pins	1-9	10-49	50
11055	24	4.98	$4.35	$3.90
11056	28	5.15	4.50	4.05
11057	40	6.81	5.95	5.35
11058	64	12.02	10.50	9.45

IC-KOOLERS™ from UNITRACK® dissipate over 2 watts of heat from IC's, producing longer life and better performance. Just push IC-Kooler on – heat is collected from top and bottom of IC and dissipated. Won't shake loose!

Stock No.	No. Pins in IC	Price
22225	14	$.29
22226	16	.29
22228	18-20	.29

SCREW MACHINED SOCKET PINS, loose, packaged in bags of 100. Stock No. 11310 is solder tail with gold collet tin shell. Stock No. 11311 is wire wrap with gold collet gold shell.

Stock No	Description	1 Bag	5 Bags	10 Bags
11310	Bag of 100 solder tail pins	$ 4.95	$ 4.45	$3.95
11311	Bag of 100 wire wrap pins	11.95	10.75	9.50



WILD ROVER

Touch switch capsule.
Operating motion is .005" without the use of a levered arm. Extremely fast on and off with low noise. Normally open – rated 115 VAC, 1.6 amp-30 milliohm resistance – .615 radius by .160 thick.

Stock No.	1-9	10 & Up
12098	$1.42	$1.28

60/40 ROSIN CORE SOLDER

Stock No	Dia	Length (feet)	Weight (oz.)	Price
50075	062	9	1.5	$1.16
50076	062	25	4	2.39
50077	062	50	8	4.25
50078	032	33	1.5	1.31
50079	032	88.5	4	2.47
50080	032	175	8	4.57

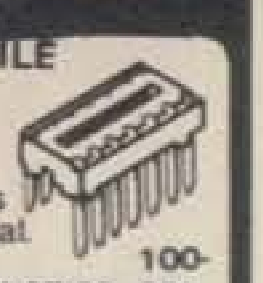
TI WIRE WRAP SOCKETS

Tin plated phosphor bronze contact – 3 wrap

Stock No.	No Pins	1-99	100-499	500
11301	8	$.40	$.36	$.30
11302	14	.59	.54	.45
11303	16	.64	.58	.48
11304	18	.73	.66	.55
11305	20	.99	.90	.75
11306	22	1.12	1.02	.85
11307	24	1.25	1.14	.95
11308	28	1.52	1.38	1.15
11309	40	2.05	1.86	1.55

TI LOW PROFILE SOCKETS

Tin plated copper alloy 688 contact pins with gas tight seal.



Stock No.	No Pins	1-24	25-99	100-999
11201	8	$.10	$.09	$.08
11202	14	.14	.13	.12
11203	16	.16	.15	.14
11204	18	.18	.17	.15
11205	20	.20	.18	.16
11206	22	.22	.20	.18
11207	24	.24	.22	.20
11208	28	.28	.26	.25
11209	40	.40	.37	.33

EKI KITS come with all parts necessary to assemble!

- Stock No. 88844 TV Jammer Kit "wipes out" your TV screen .... **$ 7.71**
- Stock No. 88850 Whooper Alarm Kit makes a great alarm or siren..... **$11.33**

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3M ScotchFlex® INSULATION DISPLACEMENT CABLES

Low profile - .050 inch centers - can be bent or folded or "zipped" to separate individual connectors. Interfaces with all insulation displacement connecters!

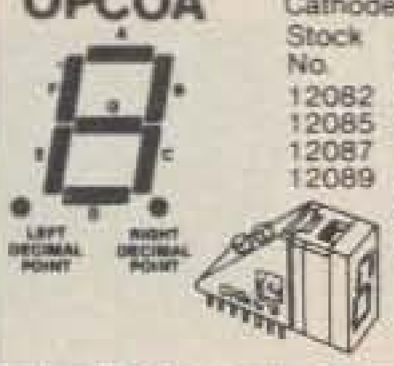
STOCK NO.	NO. OF Conductors	1 ROLL	5 ROLLS	10 ROLLS
#28 AWG Solid Flat Cable ("GREY" cable)				
03302	14	$25.20	$21.42	$17.64
03303	16	28.80	24.48	20.16
03305	24	43.20	36.72	30.24
03308	40	71.98	61.18	50.34
03309	50	89.98	76.48	62.99
#28 AWG Stranded Flat Cable ("GREY" cable)				
03313	14	$ 28.88	$ 24.38	$ 20.08
03315	16	32.78	27.86	22.95
03317	24	49.16	41.79	34.41
03323	40	81.94	69.65	57.38
03324	50	102.42	87.06	71.69
#28 AWG Stranded Color-Coded Cable				
03330	14	$ 43.94	$ 37.35	$ 30.76
03332	16	50.24	42.70	35.17
03334	24	75.32	64.02	52.72
03340	40	125.52	106.69	87.86
03341	50	156.90	133.37	109.83

Special of the Month!

ANTI-STATIC BUG BOX —has 30 compartments measuring 1" X .375" X .5" deep. Each Bug Box will store 60 eight-pin DIPs, 30 fourteen-pin DIPs, 30 sixteen-pin DIPs or 30 other small components such as transistors, diodes, resistor networks, etc. The transparent cover has a stairstep design that allows the user to empty one compartment at a time. A numbering system on the cover gives an instant count of remaining ICs.

STOCK NO.	DESCRIPTION	PRICE
12603AS	Package of 10 anti-static bug boxes	~~$ 25.40~~ $ 18.95

OPCOA



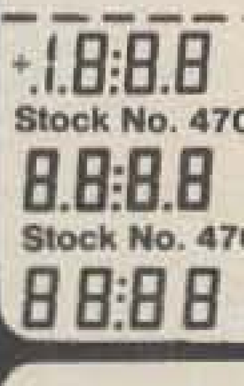
Single Digit Displays - Common Cathode

Stock No.	Color	1	100
12082	Red	$1.12	$ .99
12085	Green	1.84	1.63
12087	Yellow	1.92	1.70
12089	Orange	2.08	1.84

Right Angle Socket for Above Displays

Stock No.	1	100
11010	$1.24	$ .99

OPTEL LCD's with pins



Stock No. 47005

Stock No. 47006

Stock No. 47007

Stock No	Description	1	10
47005	3½ dig. .5"	$ 5.95	$ 5.50
47006	4 dig. .5"	5.95	5.50
47007	4 dig. .7"	11.90	11.00

The Battery Just Wrap™ Tool

New battery powered tool wraps insulated wire around .025" square posts without need for pre-cutting and pre-stripping. Complete with bit and 100 ft. 30 AWG wire

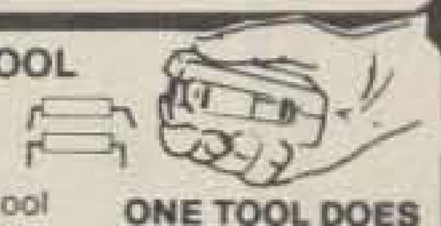
Stock No.	Description	Price
13340	Battery just-wrap tool with bit and 100 ft. 30 AWG wire	$59.95
13341	Replacement bit	10.35
13342	100 ft. blue replacement wire	7.54
13343	100 ft. white replacement wire	7.54
13344	100 ft. yellow replacement wire	7.54
13345	100 ft. red replacement wire	7.54

MICRO Charts - colorful 8½" x 11" charts eliminate the need to stumble through manuals and summaries. Fully decoded - instant access - totally comprehensive - gives pin outs, cycle times, buy notes, etc., etc.

Stock No.	Reference	Price
23010	Z80 CPU	$5.95
23011	8080A/8085A	5.95
23012	6502 (65XX)	5.95
23013	8048 and relatives	5.95
23014	54/7400 TTL Pinouts	5.95
23015	Basic Algorithms	5.95

PIN FORMING TOOL

puts IC's on their true row to row spacing. One side is for 300 centers, Flip tool over for devices 600 centers. Put device in tool and squeeze.



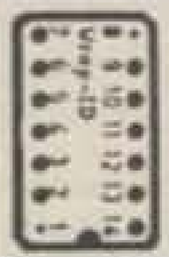
ONE TOOL DOES 8 thru 40 PINS!

	Stock No.	Price
Hand Tool	11059	$12.95
NEW! ANTI-STATIC MODEL	10200	$14.95

OK MACHINE AND TOOL

IC INSERTION/ EXTRACTION KIT

Includes DIP IC extractors and inserters to accommodate all ICs from 14 to 40 pins. Tools that engage conductive surfaces are CMOS safe and include grounding lugs. Stock No 13309 **$41.34**



SOCKET WRAP ID

Dip socket-sized plastic panels with numbered holes in pin locations. Slip onto socket before wire wrapping to identify pins. Also write on them for location, IC part number, function, etc. Simplifies initial wire wrapping, troubleshooting and repair **$1.95 per pack**

13295 - 14 pin
13296 - 16 pin
13297 - 18 pin
13298 - 20 pin
13299 - 22 pin
13300 - 24 pin
13301 - 28 pin
13302 - [illegible] pin
13303 - [illegible] pin

LOW PROFILE DIP SWITCHES

sealed bottom - gold plated

STOCK NO.	NO. OF POS.	1-24	25
10351	3	1.05	.95
10352	4	1.35	1.20
10353	5	1.45	1.30
10354	6	1.50	1.40
10355	7	1.60	1.45
10356	8	1.85	1.65
10357	9	2.10	1.85
10358	10	2.25	2.05

Scotchflex® Breadboard Systems Basic kit comes with 24 various Dual Sockets, 40 various Plug Strips, wire and tools. Kit can be used with any of the six boards.

Stock No.	Description	Price
03500	Basic Kit	$79.95
03511	Basic board, 4.5 x 5.5	19.50
03506	Intel SBC-8010 Board, 12 x 6.75	64.95
03507	Motorola M-6800 Board, 9.75 x 6	42.95
03508	S-100 Board, 10 x 5.3	36.95
03509	Z-80 Board, 7.7 x 7.5	39.95
03510	Eurocard Board, 6.3 x 3.9	21.95

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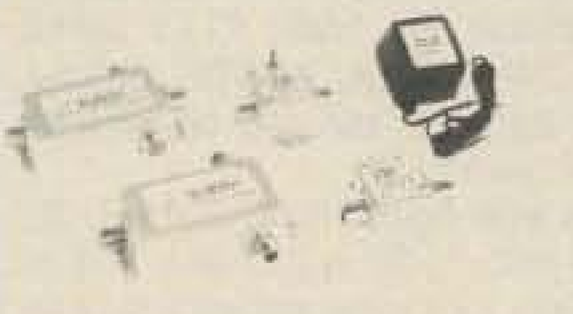
CIRCLE 12 ON READER SERVICE CARD

Free Antenna Accessories Catalog

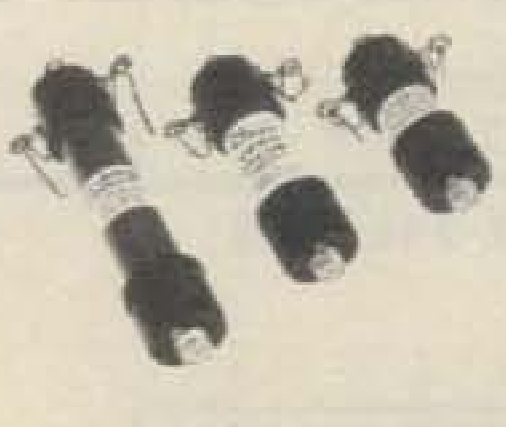


◂ Coaxial Antenna Relays

Remotely select up to 9 antennas from your transmitter, using only *one* coaxial cable. Environmentalized, high power and low loss.

W2AU and W2DU Baluns ▸

Our baluns, center insulators and insulators have been preferred for 20 years by Hams, industry, and the armed forces. Protect against TVI and lightning 1.8–200 MHz.



◂ W2VS Antenna Traps

Add these traps to your dipole and get low SWR on 2 to 6 bands, depending on how many you add. Antenna wire and custom kits also available.

Send For Yours Today ▸

Don't delay. Call or write today, and we will send you free literature which fully describes our Ham antenna accessory product line.

Dealer inquiries also welcome.

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CIRCLE 70 ON READER SERVICE CARD

NEW! **RTTY TODAY**

MODERN GUIDE TO AMATEUR RADIOTELETYPE

Just Released!

$8.95 Plus $1.75 Shipping & Handling

"RTTY TODAY"—the only up-to-date handbook on RTTY available, covering all phases of radio-teletype. Answers many questions asked about amateur RTTY. Extensive sections fully cover the home computer for RTTY use.

Authored by Dave Ingram, K4TWJ, a noted authority on RTTY. Written in a clear concise manner, all material is new and up to date and covers the most recently developed RTTY equipment and systems. RTTY TODAY is fully illustrated with photos, diagrams, RTTY station set-ups and equipment. The latest information on the new generation RTTY. Just published.

World Press Services Frequencies

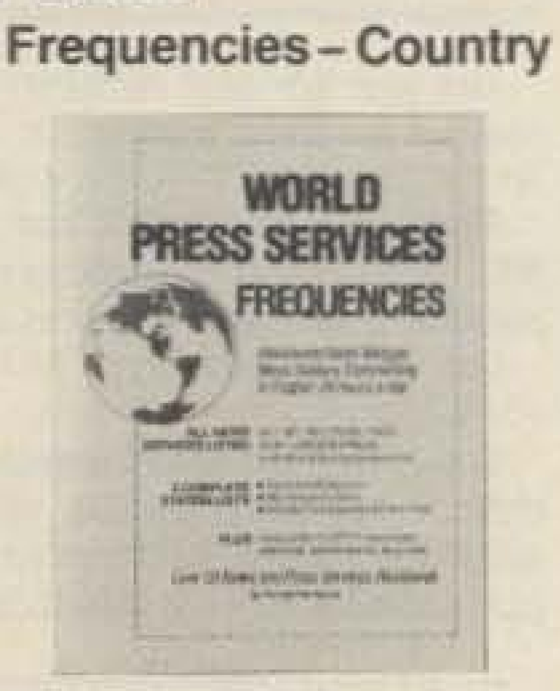
60 Radioteletype Services – 4th Edition
3 Large Master Lists By Time – Frequencies – Country

A comprehensive manual completely covering the field of radioteletype news monitoring—contains all needed information on antennas, receivers, terminal units, monitors, how to receive, frequencies and times of transmission for most world radioteletype news and press services.

Monitoring these news sources is fascinating shortwave listening.

Be better informed on world events and happenings, hours and even days in advance of radio, TV or newspapers.

Contains three different master lists of times of transmission, frequencies used, plus the ITU list of over 60 different news services in all parts of radio and shortwave listening that everyone can enjoy.



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N6ML discusses considerations not usually taken up in antenna handbooks. Strength of materials sometimes is not as important as strength in the community.

How To Design A Real Estate Efficient Antenna Farm

Part I

BY MICHAEL JOYCE*, N6ML

In virtually every issue of all the amateur radio magazines are articles concerning squeezing the last 0.1 dB from an antenna. Other articles expound on construction techniques or evaluate the latest commercial offerings. No antenna installation is ever as simple as going to the store, purchasing a tribander, going home, assembling the antenna, raising the antenna, and getting on the air. During the antenna installation many problems occur that often are not electrical in nature, and therefore tend to be overlooked in the typical antenna article. This article will attempt to stimulate the reader into evaluating the "real estate efficiency" of his antenna farm and will give installation examples complete with problems.

Real Estate Efficiency: In amateur radio this term does not mean a one-room apartment with kitchenette and fold-out bed, but rather it means getting the maximum antenna farm cultivated on existing property. To achieve maximum real estate efficiency, public relations, planning, and installation are necessary.

Public Relations (PR)

There are two distinct factions of PR. **Overt PR**, the more media attractive of the two, generally sounds like the following: "Hams keep communication vigil during hurricane David"; "Tune in the world with ham radio"; local hams help police find lost child." Amateur radio recently engaged in a media blitz of overt PR with Grenada and the Space Shuttle. Not belittling these facts and accomplishments, the amateur finds himself dealing in **Covert PR** daily. Covert PR is a mixture of tact, common sense, and patience.

Joe Yagimaster, after surveying his wallet and newly acquired home, determined that he had the land and money to erect a 70 foot tower on which a 5-element 20 meter monobander (his only band interest) would nest. Joe erected the tower and beam using the labor of some local amateur friends. During the installation a few of Joe's neighbors wandered over to ask the usual questions: "You CB?"; "You got a license for that?"; "You gonna mess up my TV?"

Joe politely answered the questions. However, it was apparent that Joe was busy and did not want to be bothered. Joe, something of a compulsive 20 meter DXer, had little time to socialize with his neighbors. He became known as the grouch with that monster antenna devaluating the neighborhood property. During the next year Joe successfully defended his right to his tower in court, answered four FCC r.f.i. inquiries, and caught three kids trying to cut the guywires on his tower. Joe put his house up for sale and moved out of the "bad" neighborhood.

Far fetched? Not at all. In fact, situations similar to Joe's are happening more often. Possibly the saddest part of the tale is that it could have been prevented. Joe, considered a model amateur and DXer by his amateur buddies, could not understand his misfortune. Joe had not mastered Covert PR.

Al Bigarray saw Joe's for-sale sign. Al walked around Joe's yard, looked in windows, and then started talking to the neighbors about the neighborhood. Al thought to himself, "The yard's a bit small, but there are a lot of features that would facilitate erection of a four-element triband quad plus some inverted Vee's. (Note that this is somewhat more ambitious than Joe's installation.)

Al bought the house and immediately installed a 40 meter vertical on his roof. ("Hey, Al, when are ya gonna put up your TV aerial?") Al painted his house, helped his next-door neighbor build a workbench, fixed up his yard, volunteered to prune the elderly widow's palm tree, and became the neighborhood boy's league soccer coach. Four months later he erected his old three-element Yagi tribander with the assistance of several of his nonamateur neighbors. That evening he invited his helpers over for a drink and to enjoy the fruits of their labor. When the nonamateur neighbors left later, they were all delighted because they had met ZS6XYZ, VK3XXX, and UA3ZZZ. ("Martha, I'll bet you'll never guess who I talked to tonight—Russia!")

By the end of his first year Al had collected enough parts to build his four-element quad, and he had also acquired a 70 foot tower (sound familiar?). With the help of two amateur buddies and three neighbors, Al erected the tower in one weekend, and assembled and raised the quad the next. When queried about Mr. Al Bigarray, the typical answer probably was, "Oh, you mean the wonderful guy who helped my Stevie with his science project." And after the phone patch to her grandchildren across the country, the elderly widow neighbor thought that running a leg of Al's 160 meter dipole to her palm tree was no bother at all!

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Al was a master of Covert PR. This mastery worked to give Al's antenna system an invisibility. Also, the remarkable point to the story is that Al felt almost as good about the good deeds he had done for his neighbors as he did about the JT1 he had worked on 80 meter c.w. (nothing feels that good!). Some techniques of Covert PR are:

1. Get involved with the neighborhood children. Parents have a tough time criticizing your antenna farm when you are helping to keep their children out of mishief.
2. Start with a smaller antenna, water and fertilize it, and encourage it to grow every three months or so.
3. Never criticize the Citizen's Band in general to your neighbor. He may be a CBer.
4. Get the neighbors involved in your installation. Ask for opinions on guying locations, the right consistency of concrete, how deep to dig for the base, etc.
5. Ask for neighbor assistance in raising the tower and antennas. The smoothest installations at N6ML have come from a crew of two experienced amateurs and three to five nonamateur neighbors. The advantages are that nonamateur neighbors tend to do as they are told during the installation, not questioning your every step, and it is hard for the nonamateur to criticize an antenna if he helped install that system.
6. Always invite the nonamateur neighbor to come over and listen to your rig with the new antenna. It is possible he could be a latent amateur, so this tactic has a functional duality.

The benefits of Covert PR come to the forefront when one is renting and wishes to install an antenna system. When I was in college and renting a unit in a duplex, Covert PR was successfully used to erect a three-element 20 meter quad. The 66-year-old landlady who resided in the other unit of the duplex was consulted, assisted in the planning, and climbed a ladder on the top of the second story to help with the placement of elements during installation. It was determined upon completion that the antenna was much too large for the yard, and the antenna was dismantled without a contact ever being made. When told of this, the owner stated, "Heck, all that work and we didn't even give it a chance!"

Occasionally it becomes necessary to apply **Reverse Covert PR**, which is actually a euphemism for passive arm twisting. An example of Reverse Covert PR happened at the above-mentioned QTH. City regulations required a special zoning permit for structures over 25 feet tall. The law was designed for minimum casualties during earthquakes. It was vague enough to include antennas. An application for the permit cost $200, and the zoning commissioner said that permits of that nature seldom passed. However, he said unofficially that as long as no one complained, the commission looked the other way on amateur antennas. A neighbor who barely tolerated my tribander at 30 feet had a telephone-answering tape recorder that activated when a 28 MHz signal was transmitted nearby. The neighbor refused to accept responsibility for the recorder's r.f.i. problem and ignored an invitation to seek advice from the FCC. The neighbor instead decided to check with the zoning commission. With the knowledge of the zoning law, the neighbor attempted to coerce me into abandoning 10 meters. To this I replied, "As I talk to you, I can see at least four TV antennas over 30 feet high, including your father-in-law's. I'll take down my tribander to abide by the laws, but since I'm a college student with bunches of free time, I'd be compelled to take my bicycle and go down every street in town to report zoning violations. Of course, everyone I report will also get a letter explaining who gave me my lesson in civic pride. It will make a bunch of folks angry, but justice will be served."

The neighbor never mentioned r.f.i. again. With careful watering and fertilizing, the tribander grew 5 feet every three months until it attained a height of 45 feet. It remained at that height for 18 months until it was dismantled for relocation in Florida.

Now that a certain expertise in Covert PR has been attained, you have your neighbors eating out of your discarded chassis, and of course, the XYL is agreeable (all amateurs are waiting for the article on getting the XYL agreeable), proceed to planning your antenna farm.

Planning Your Antenna Farm

Any decrease in neighborhood value caused by a large antenna system should be repaid, and preferably it should be *prepaid* in full with generous interest through neighborly service. We will not give advice on how to deal with city zoning laws and XYLs other than to say it is easier to operate within the law and with the XYL's backing.

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Tower Considerations

An ancient amateur radio axiom is "A wet spaghetti noodle operates satisfactorily as a mast if enough guywires are used." Exaggerated certainly, but it brings out a point. A less-expensive tower with a well-designed guying system is capable of supporting loads that larger and much more expensive self-supporting towers would forsake.

Fig. 1 is a typical city lot with a modest home of perhaps smaller than average size. The most practical location of a guyed tower is at point **A**. To guy this tower, guy anchors should be placed near points **X**, **Y**, and **Z**. These points do not represent a perfect 120-degree guying pattern, but they do represent maximum distances from the tower for a practical system. This will be discussed later.

1. Guy Anchors

A second ancient amateur radio axiom is "It is better to use less concrete on the base and more on the guy anchors." Observe many commercial installations. Many of these towers come to a pointed base and rest on a pin.

The *ARRL Antenna Handbook* has been a standard for information on classic guy anchors. Too often, though, the classic guy anchor is impractical for installation due to space limitations, easements, or physical hazards. Whenever possible, it is desirable to raise the guying anchor point so that one can walk under any part of the guy leg. Often it is possible to buy a "condemned" power pole from the power company. This pole then can be sawed (with a chain saw) into 13 foot lengths. The pole is then planted in a 5 foot hole dug with posthole diggers. A hefty eye bolt is screwed into the pole approximately 1 foot from the top. This anchor could serve another purpose as a support for the XYL's clothesline. Not only does this lessen the physical hazard, but it improves the guy angle. There are several other methods that can accomplish this. Perhaps the simplest is to screw an eye bolt into a telephone pole or a stout tree. "Gasp," you say, "that's illegal!" Is it? Recently at N6ML it became necessary to anchor to a telephone pole located on my property. A telephone call was made, and permission to use the pole was granted under the stipulation that the guy would not interfere with servicemen climbing the pole. *Get permission to use the pole first!* Often the utility companies will go along with guying requests. Here are two tips on approaching them: Talk to a supervisor or higher-up person; show him a detailed drawing of your intentions.

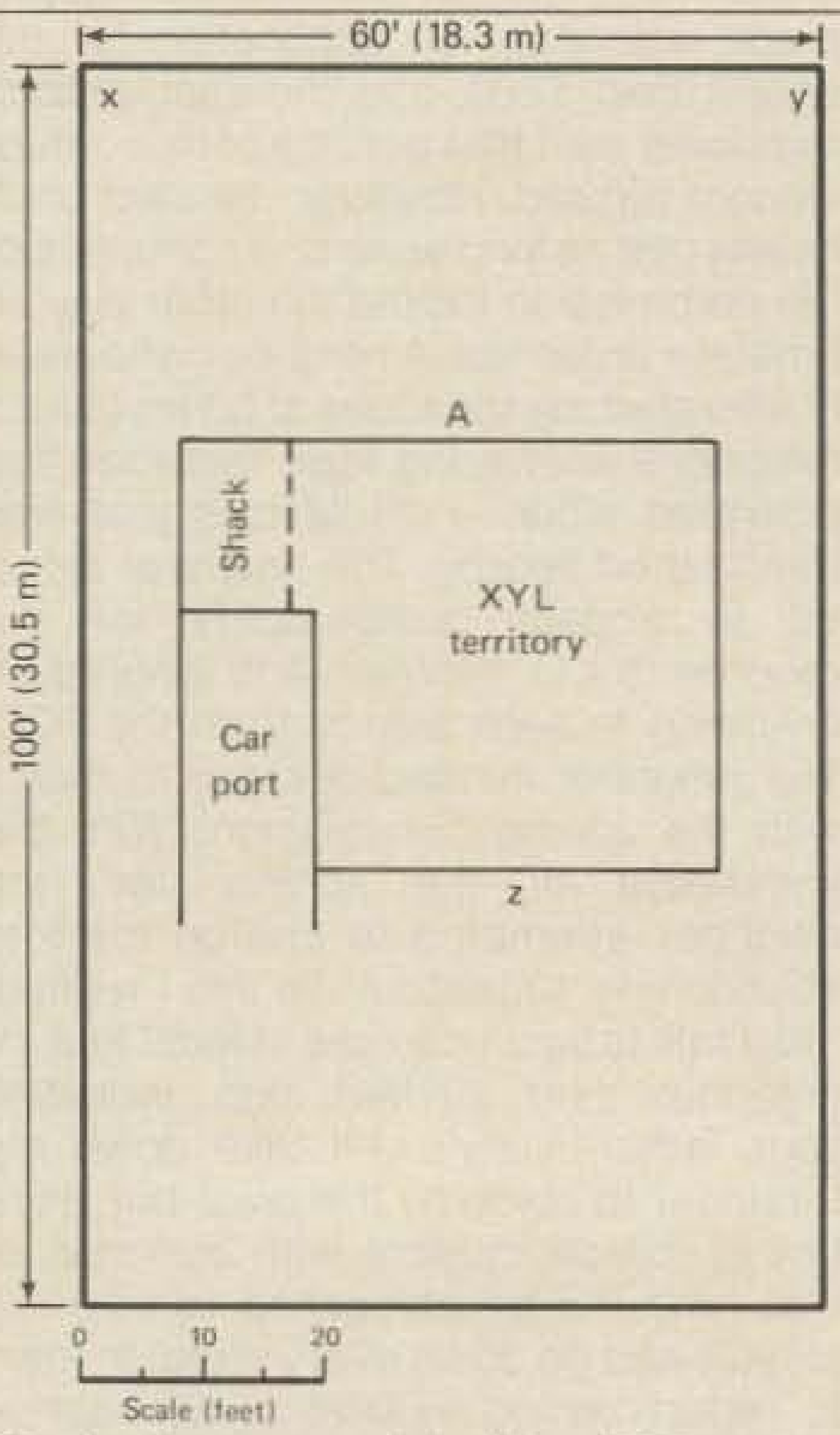

Fig. 1– An average lot with a 1000 square foot house. The tower is located at point A, and guying locations are at X, Y, and Z.

Another method involved the use of a pole or iron pipe braced against a structure and buried, preferably in concrete. Fig. 2 depicts a type of pole anchor used at N6ML. A pole or pipe anchor is particularly useful when a long guy run is necessary to clear an obstacle such as a roof (refer to fig. 1). At point **Z** a pole anchor would prevent guys from coming into the front lawn. Often the pole can be hidden behind shrubs or painted to look like a normal porch support. An ingenious amateur could possibly combine the anchor as a support for a 40 meter groundplane!

Another idea for guying anchors is corner posts of hurricane fences (chain link) that are sunk in concrete. These posts have the added strength of the rails at the top combining with the concrete to form an elementary second-class level (see fig. 3).

2. Attaching Guys to Tower

There is much documentation on breaking up guys with insulators and the use of wire clips, but little has been written about attaching the guy to the tower. Amateurs have wrapped the guy around a tower leg, pulled it taut, and had satisfactory operation. Often towers are bolted to the side of a building to give extra support. This sometimes introduces the problem of where to attach the guys in the case of our average QTH of fig. 1, because a tower leg is not located in the direction of the guywire. A simple solution is shown in fig. 4(A). Bed rails obtained from a thrift shop for a dollar each make excellent angle stock, fig. 4(B).

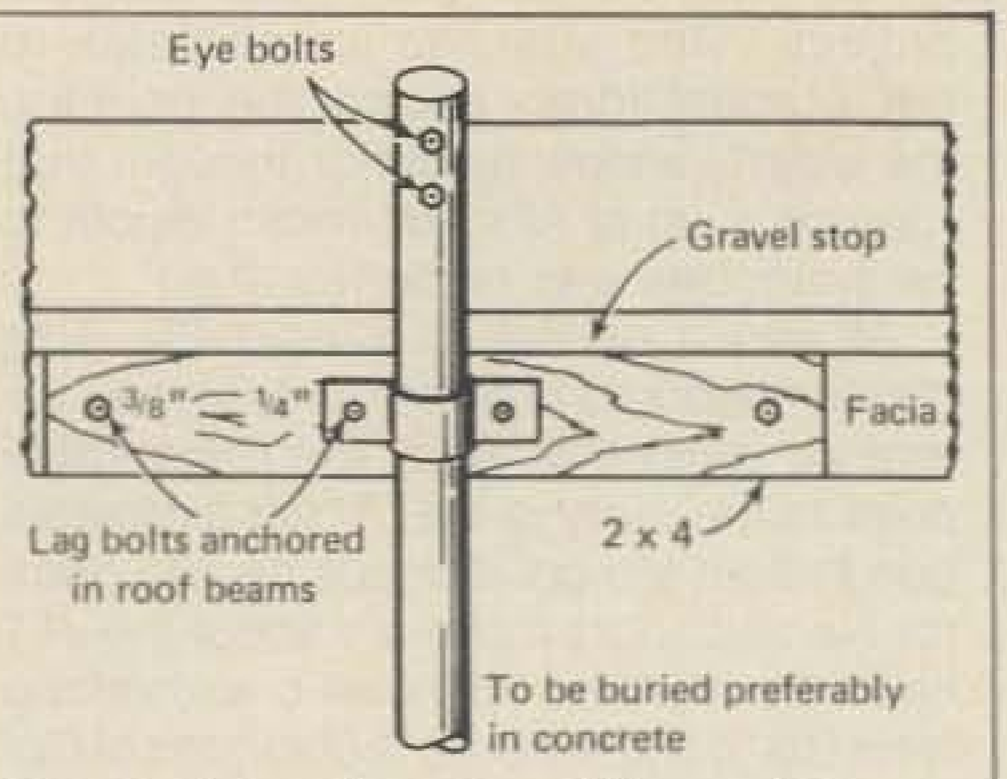

Fig. 2– Using the edge of the roof to support a guy anchor pole.

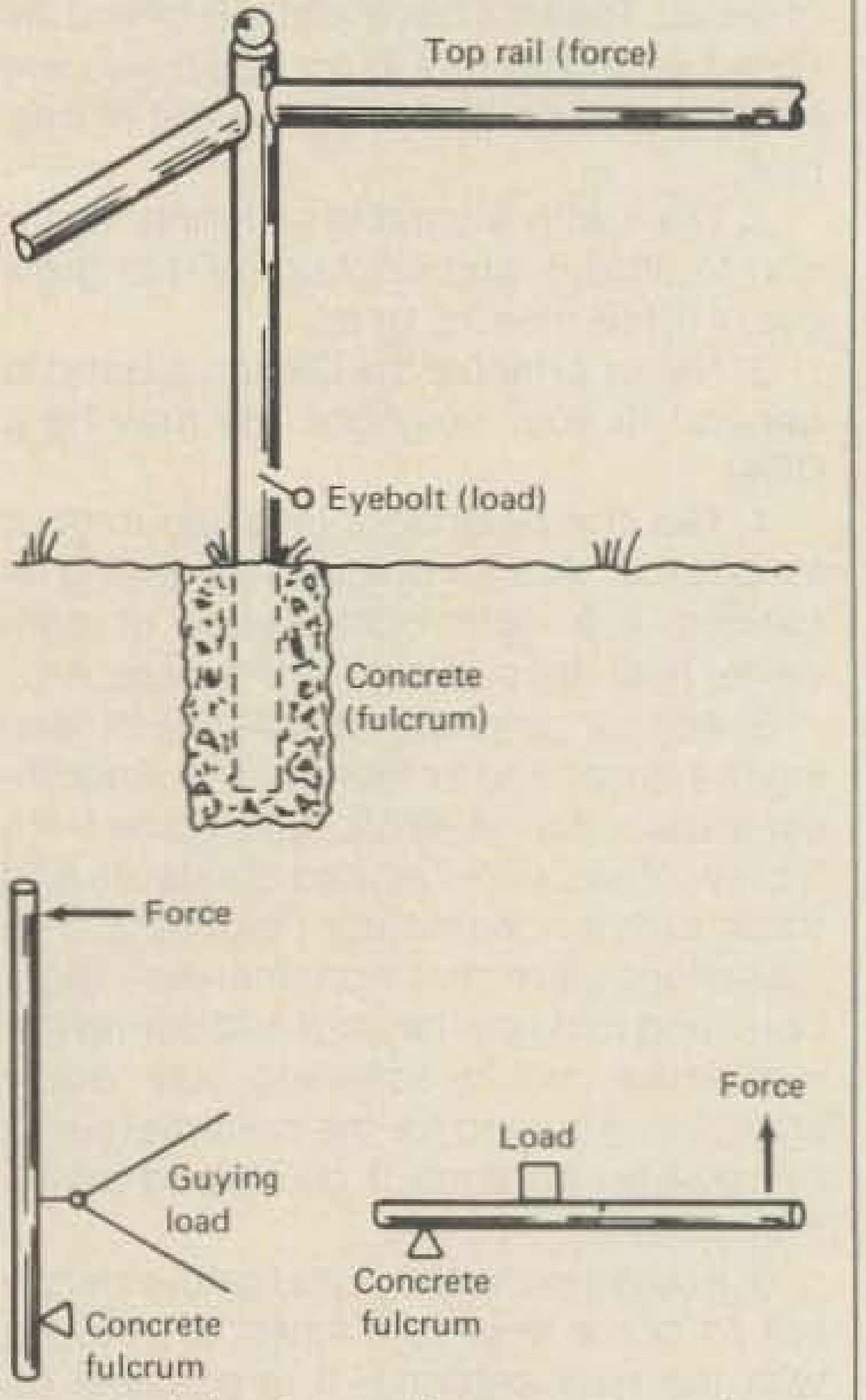

Fig. 3– A hurricane fence post used as a guying anchor.

In the southeastern and gulf-coast states, where high winds from tropical storms are common, a system to defeat this tremendous torque must be developed. Due to the braking action of rotator, the point at which the rotator is attached to the tower is where the torque transfer takes place. The simplest means (and cheapest in the long run) to absorb this torque is to mount the rotator at the base of the tower and run a mast the length of the tower. The mast absorbs the torque. This method becomes mandatory when heavy rotators, such as prop pitch motors, are used on lighter towers. A thrust bearing is placed at the top of the tower to absorb vertical thrust and lateral movement. Simple bearings made of aluminum flat stock and PVC are spaced the length of the tower to maintain the position of the mast (fig. 5).

If the rotator is mounted at or near the top of the tower, a torque reduction system should be applied. Some tower manufacturers sell torsion bars for use in guying. An inexpensive torsion bar is shown in fig. 6. A set of four guys are used with the bar. The bar should be mounted at or just above the rotator.

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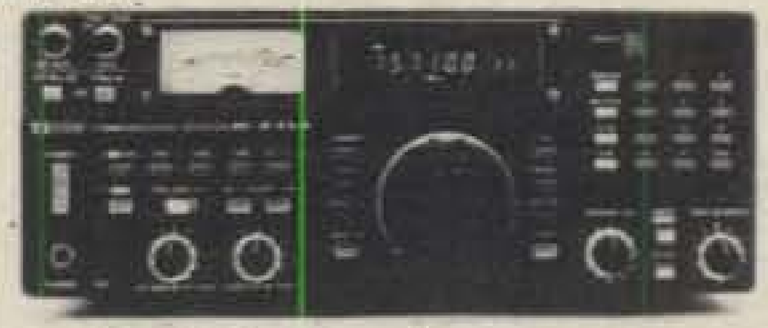

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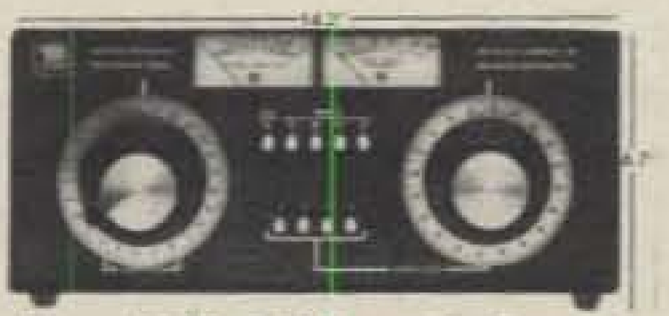

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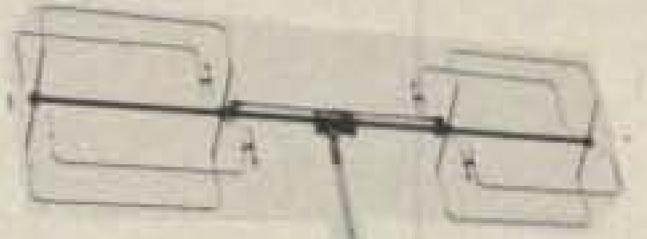

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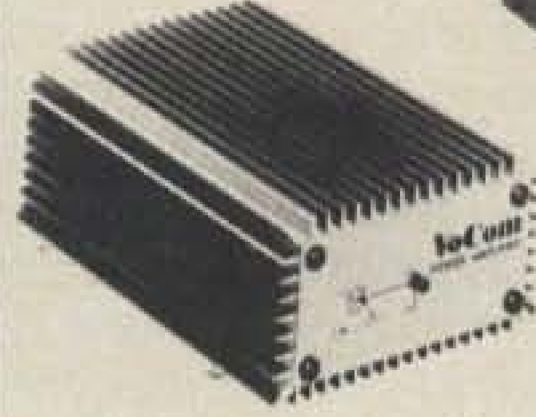

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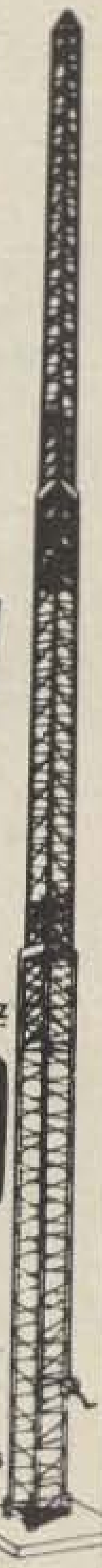

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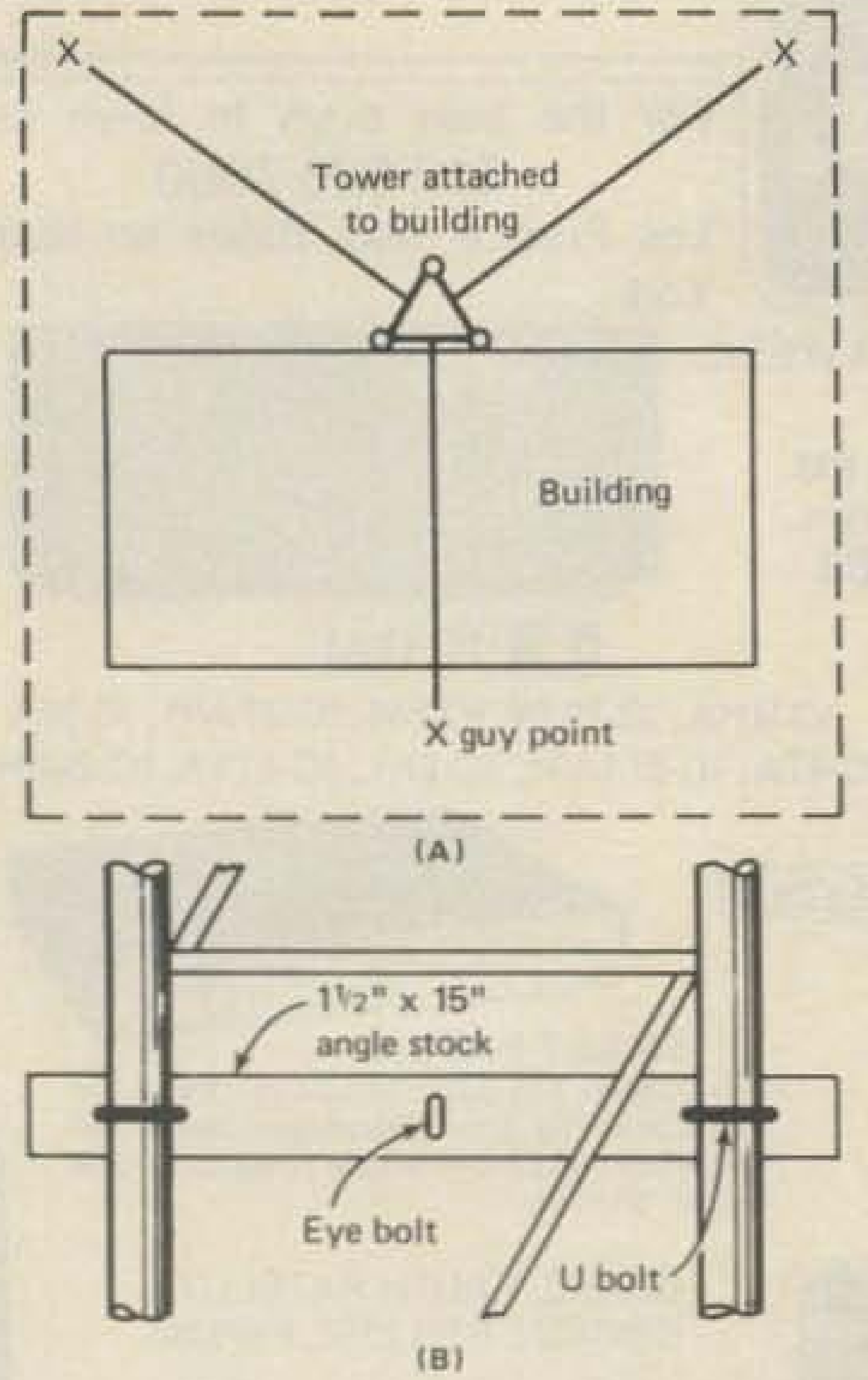


Fig. 4– (A) The tower legs are not in the direction of the guywire. (B) Using steel angle stock, the guying configuration can be changed easily.

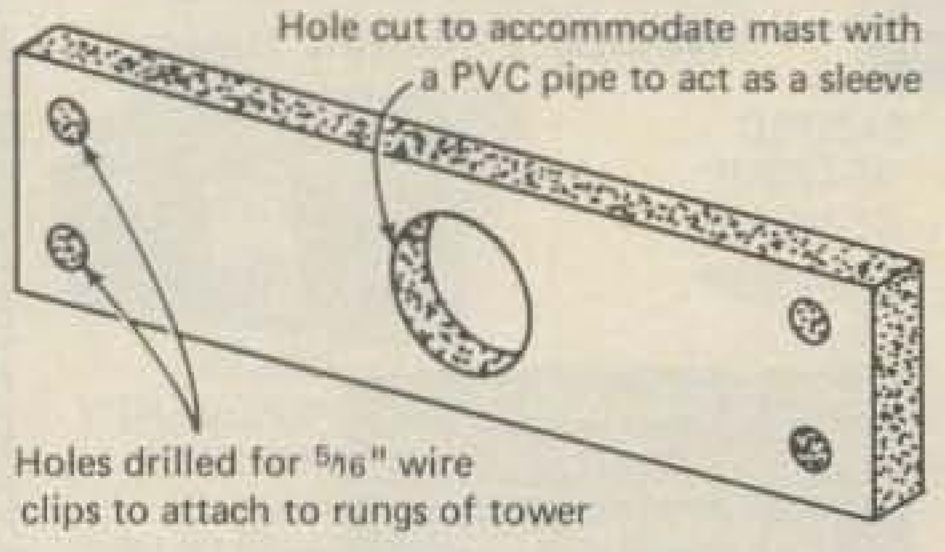

Hole cut to accommodate mast with a PVC pipe to act as a sleeve
Holes drilled for 5/16" wire clips to attach to rungs of tower

Fig. 5– How to make mast bearings.

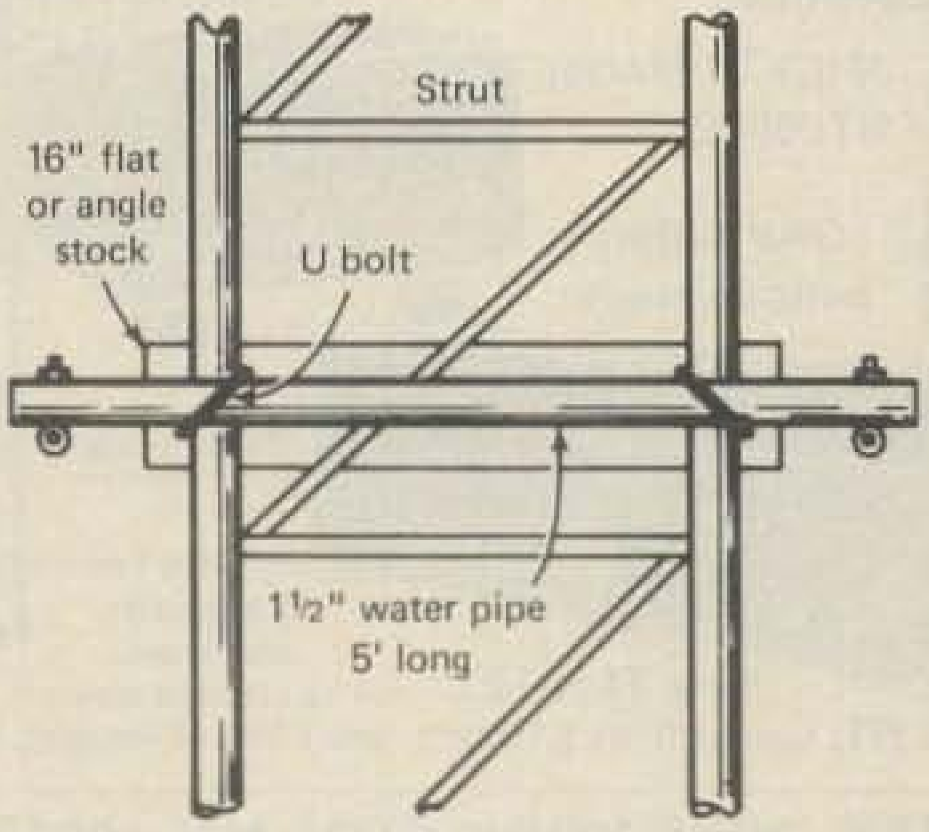
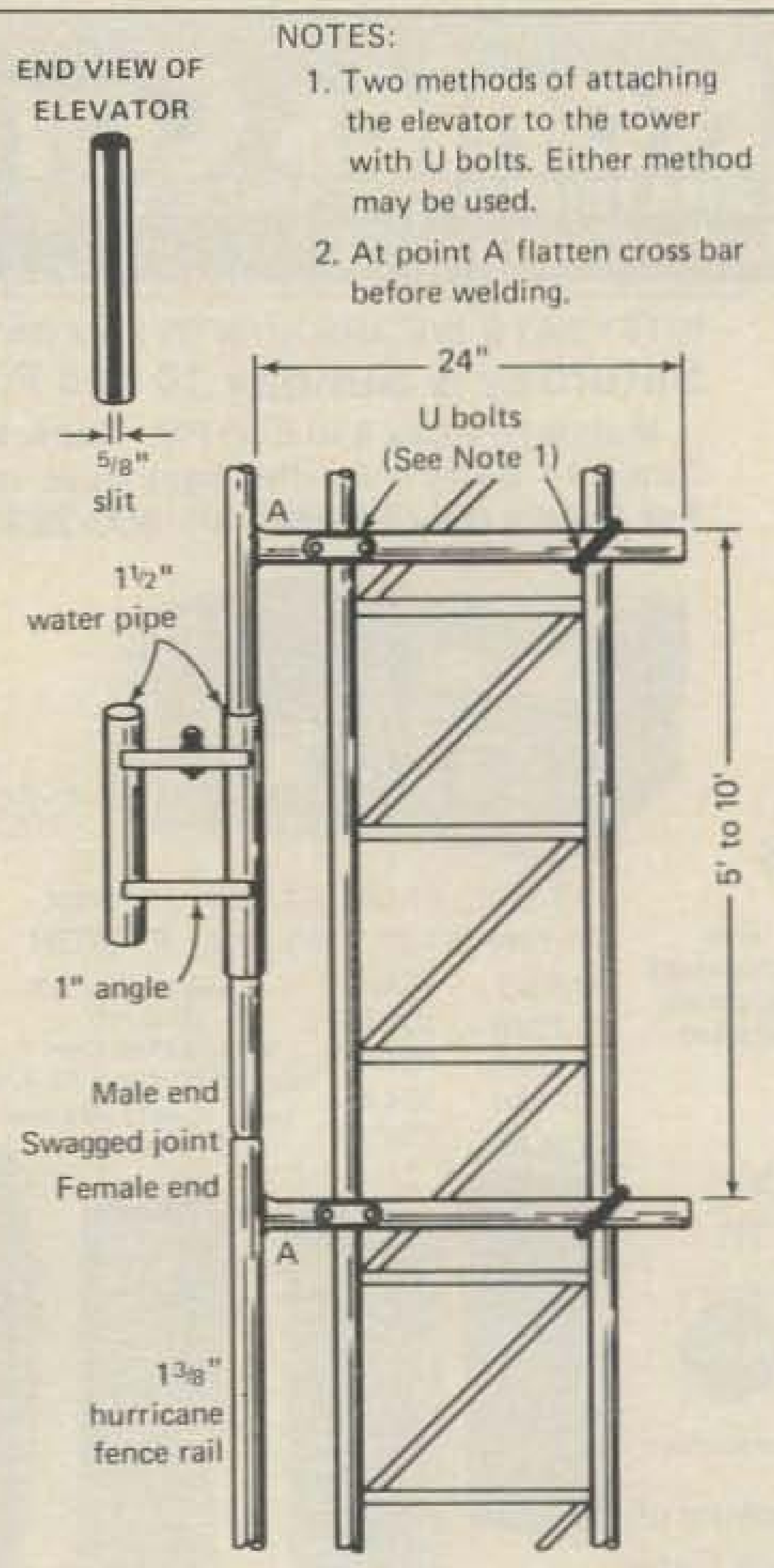


Fig. 6– How to make a tower torsion bar.

Although this system appears less expensive than masting the length of the tower, a cost breakdown shows the false economy in Table I.

3. Getting the Antenna to the Top of the Tower

Many elaborate systems have been devised to get a beam on top of a tower. Amateurs with crankup, tiltover, or breakover towers have few problems compared to the amateur with a rigid, guyed tower. An issue of *CQ* featured on its cover a hot-air balloon used to hoist a big Yagi to the top of a tower. Less exotic methods include renting cranes, building the beam in place, and probably the most common, sliding the antenna up a pair of ropes. When erecting large quads, it may be most practical to build the antenna with the boom attached to the tower at a much lower level, and then hoist it to the top. A rail and elevator system, along with a gin pole, is a simple and efficient way to accomplish this hoist. Many radio clubs have a gin pole as club property. The following rail and elevator is designed to be quickly assembled and disassembled, is inexpensive, and makes a great afternoon club project.



NOTES:
1. Two methods of attaching the elevator to the tower with U bolts. Either method may be used.
2. At point A flatten cross bar before welding.

Fig. 7– N6ML antenna elevator system.

Fig. 7 shows the rail installed alongside a typical tower such as the Rohn 25. Hurricane fence rail, 1.375 inch OD, is used for the rail and cross supports. The cross supports are flattened at one end before welding to provide a narrow obstacle for the slot cut in the elevator. The dimensions given in fig. 7 are for a universal model; however, there is no reason why the rail cannot be customized to suit a particular tower. The rail sections should be swagged at one end of each length to provide a smooth joint.

Operation of the rail is simple. A rope goes to the eye bolt on the elevator, to the gin-pole pulley, and down the tower to a winch or to Mr. Armstrong. The antenna is built on the elevator in such a manner that the fewest number of guys will interfere with the elevation. The guys that will interfere are replaced by temporary rope guys attached approximately 1 foot above the permanent guy on the tower. These permanent guys are disconnected from their anchors and brought next to the tower. As the antenna is raised to a guying level, the permanent guy is reinstated, and then the temporary guy is removed. When the antenna reaches the top of the tower, the tower is climbed and a pin is placed through the rail, under the elevator as a stop. The rope is then removed from the eye bolt and tied on the boom using a clove hitch and half hitches. The antenna is hoisted from the rail to the mast, with the tower man guiding and balancing. It may be necessary to tie an additional rope on one end of the boom to keep the antenna from swinging as it is being hoisted. A loose loop is adequate and ensures easy removal.

Long Mast	
60', 1.375" fence rail @ 40¢ ft.	$24.00
Miscellaneous nuts, bolts	1.50
Homebrew thrust bearing	5.00
2" OD mast, 10', galv., $1.92/ft.	19.20
2 ea. rotator plates, Rohn @ $11.00 ea.	22.00
Total cost	$71.70
Torsion Bar	
352', 3/16" galv. guywire, 19¢/ft.	$ 66.88
80 ea. wire clips, @ 40¢ ea.	32.00
Homebrew thrust bearing	5.00
2" OD mast, 4', galv., $1.92/ft.	7.68
4 ea. turnbuckles, @ $3.50 ea.	14.00
2 ea. rotator plates, Rohn @ $11.00 ea.	22.00
Guy anchors, 16 ea., guy insulators, surplus	30.00
5', 1.5" ID water pipe (torsion bar) @ $1.76/ft.	8.00
Miscellaneous nuts, bolts	3.50
Total cost	$181.06

Table I– Torsion system comparison. This table was drawn up under the assumption that all hardware must be purchased, either new or surplus. The figures are based on the guys being broken up every 20 feet, using four wire clips at each insulator, and each guy being insulated from the tower. Guy anchor cost was estimated conservatively at $10.00. The torsion bar guys are in addition to the regular guying system.

Antenna Considerations

We've obtained our neighbor's permission and possibly some of his muscle, and we've designed a well thought-out tower and erection system, so now the question is, "What are we going to put up?" This brings this article back to the opening statement. The decision is yours. In Part II a photo essay will describe the erection of a "monster quad" that was erected at N6ML in August of 1980.

(To Be Continued)

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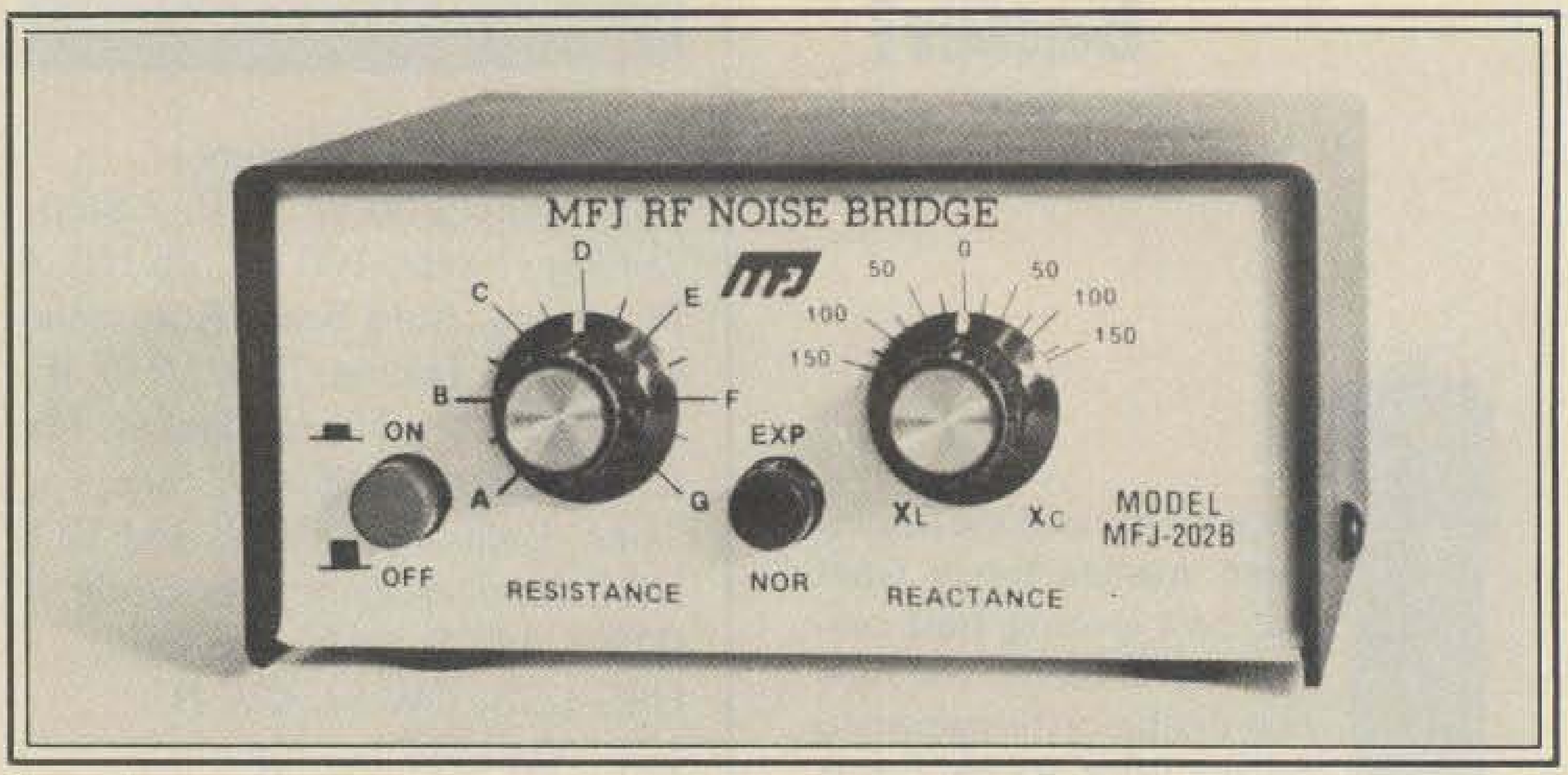
CIRCLE 15 ON READER SERVICE CARD

CQ REVIEWS:

BY JOHN J. SCHULTZ*, W4FA

The MFJ-202B R.F. Noise Bridge



Front view of the MFJ-202B.

I can't deny that I am a noise-bridge fan, and over the past few years two noise-bridge construction-type articles of mine have appeared in *CQ*. Therefore, I was quite interested in reviewing the MFJ-202B Noise Bridge and putting it through its paces.

I think that the noise-bridge concept is one of the least appreciated as far as amateur radio test and adjustment equipment is concerned. The noise bridge is still regarded by many amateurs, I think, as only a sort of "no-power" antenna-tuning unit adjustment device. Of course this is true, and the noise bridge was once used as a classified military device to allow for the "silent" tuning of antennas, particularly on submarines. However, in modern-day reality the noise bridge essentially can replace a grid-dip meter and do most of the things that venerable old instrument can do with far greater accuracy. The reason for this is that the noise bridge must be used together with a communications-type receiver. The frequency calibration of the communications-type receiver essentially replaces the crude frequency calibration on a grid-dip meter. For example, almost any present-day communications-type receiver will have 1 kHz resolution at 21 MHz. Almost any grid-dip meter, on the other hand, doesn't even have 500 kHz resolution at 21 MHz. This difference in frequency accuracy may not be of major significance when one is trying to determine the rough value of an L or C component, but it can be of major significance when one is trying to determine the resonant frequency of an antenna or LC lumped circuit (the latter being, more or less, the traditional application of a grid-dip meter).

Rather than dwell on generalities regarding the use of a noise bridge, this article first will briefly describe the makeup of a noise bridge, characteristics and application of the MFJ unit, and results using the MFJ unit.

Noise Bridges in General

The noise bridge, as its name states, is a classic bridge-type device and operates as shown in fig. 1. The broadband noise source covers a large spectrum of frequencies and provides the equivalent of an r.f. signal being generated simultaneously from 3 to 30 MHz, for example. The bridge circuitry uses a communications-type receiver as a detection device. When the bridge is balanced—that is, the resistance/reactance of the internal adjustable arm is equal to the resistance/reactance connected across the "unknown" terminals—the noise signal heard in the receiver will be at a minimum. When the bridge is unbalanced, the noise signal heard in the receiver will increase sharply. The accuracy to which the bridge can measure an unknown resistance/reactance depends upon the accuracy of the components in the variable arm of the bridge and upon the accuracy of the frequency readout of the detection device. Of course, the bridge can be used in "reverse." That is, the variable arm is set at some desired value (e.g., 50 ohms with no reactance) and the unknown resistance/reactance is varied to produce a null, and therefore, match in value that to which the noise bridge arm was set.

In most practical noise-bridge designs a balanced transformer output is used, as will be seen in the MFJ design. Also, a small "trick" is used so both unknown inductive and capacitive reactances can be measured, although the noise-bridge variable arm contains only a variable capacitor for reactance adjustment. A capacitor roughly half the value of the variable one is placed permanently in the "unknown" arm of the bridge. Then, zero reactance on the noise bridge is indicated when its variable capacitor arm is roughly at midpoint, and excursions to one side of the midpoint represent capacitive reactance, X_C, and excursions to the other side represent inductive reactance, X_L. However, aside from these "variations on a theme," the basic operation of a noise bridge is based upon the classic Wheatstone bridge idea shown in fig. 1.

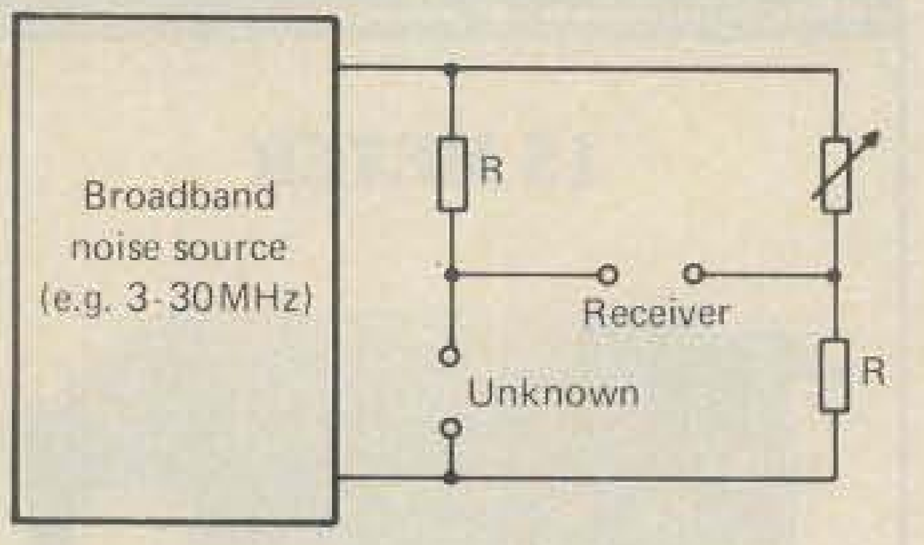
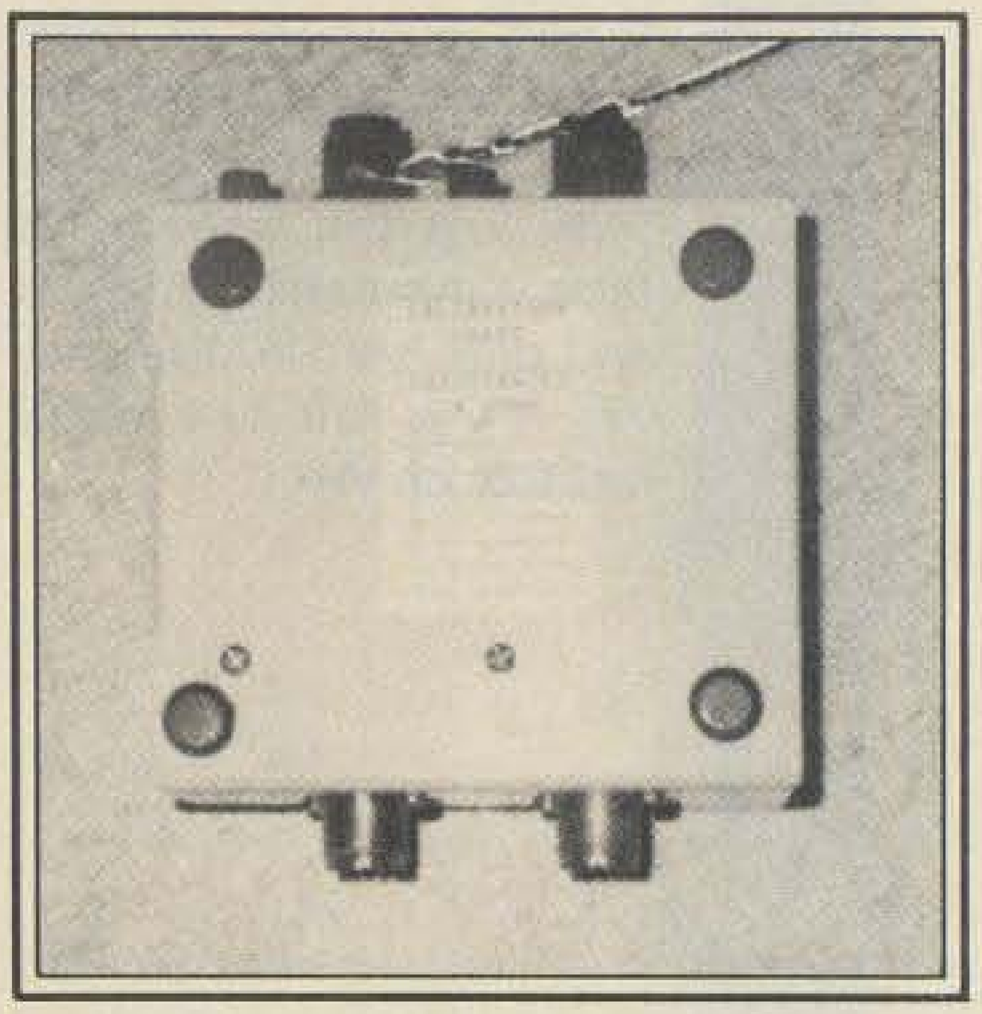


Fig. 1– The basic idea of an r.f. noise bridge.



Bottom view showing the individually calibrated resistance chart placed on the bottom of each unit.

Specifications and Circuitry of the MFJ-202B

The specifications of the MFJ-202B are shown in Table I. Its frequency coverage essentially covers the 160 to 6 meter range con-

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*c/o CQ magazine

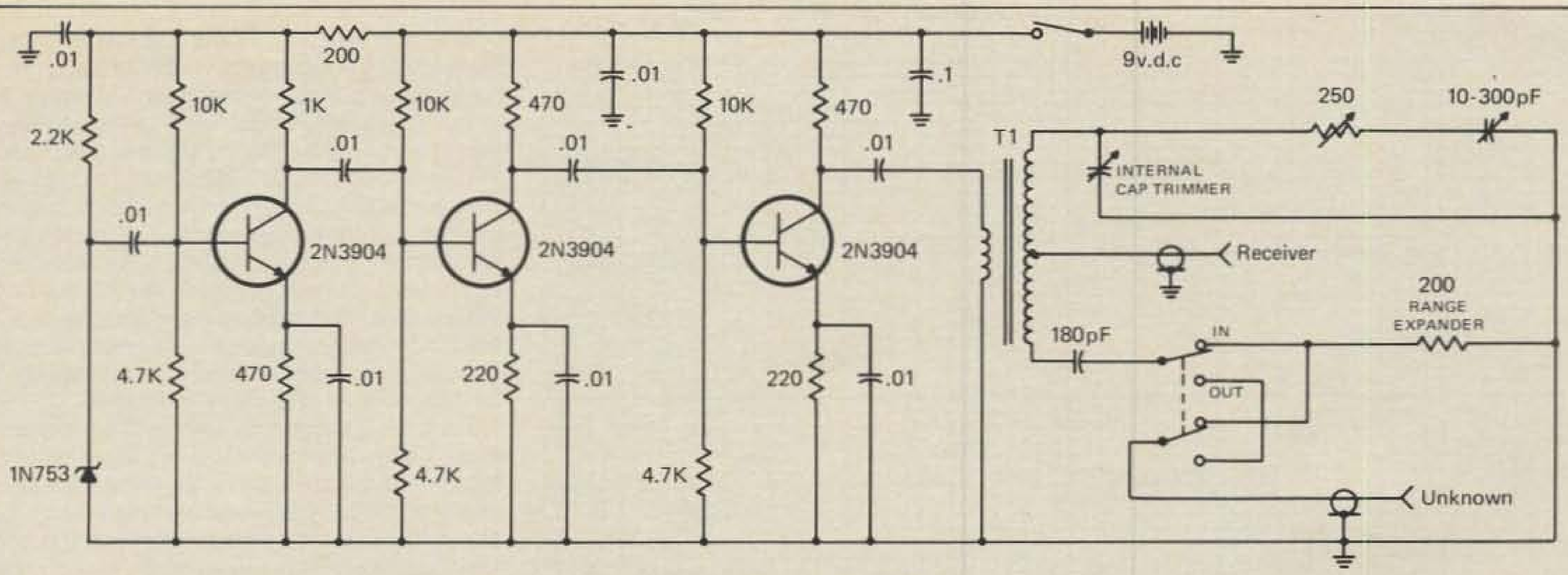


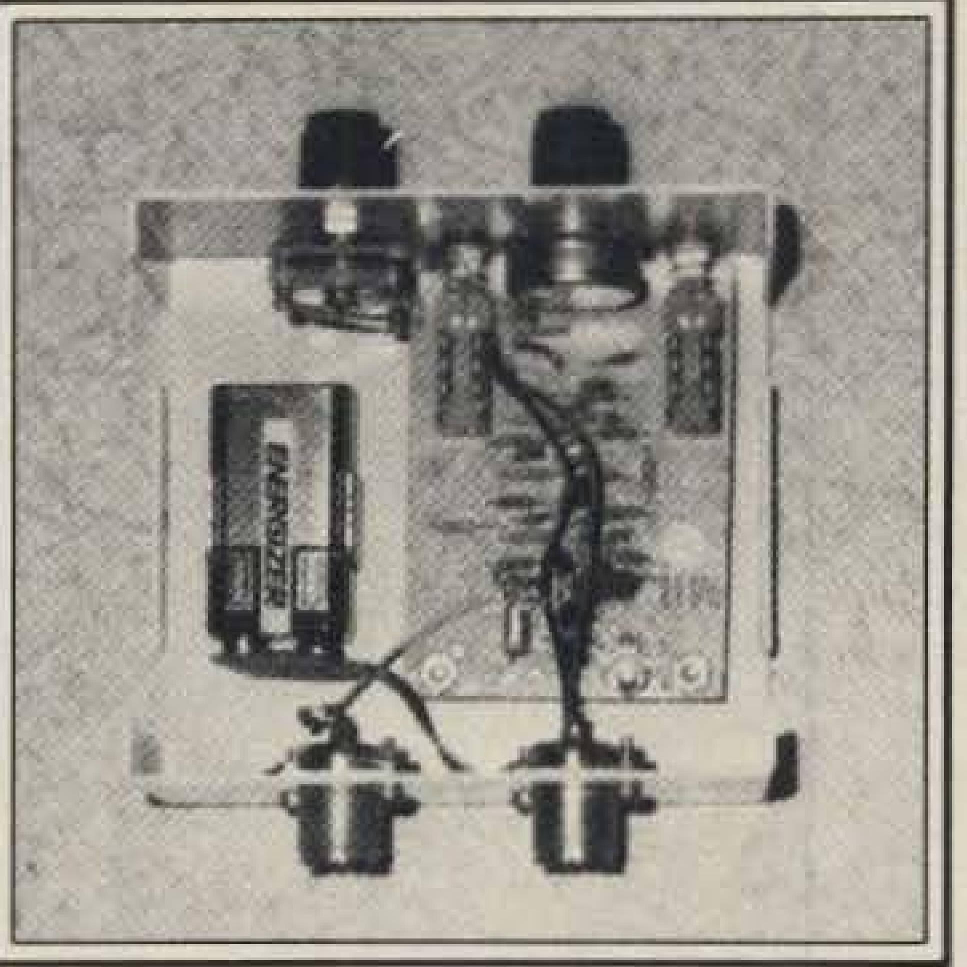
Fig. 2– Circuit diagram of the MFJ-202B noise bridge.

Frequency Range: 1 MHz to 100 MHz
Impedance Range:
  Without using Range Expander
    Unknown resistance range: 0 to 250 ohms at 1 to 100 MHz
    Unknown inductive reactance range: 0 to 500 ohms at 1 MHz, 0 to 5 ohms at 100 MHz
    Unknown capacitive reactance range: 0 to 15 K ohms at 1 MHz, 0 to 150 ohms at 100 MHz
  Using Range Expander
    Unknown resistance range: 0 to 2000 ohms at 1 MHz, 0 to 2200 ohms at 4 MHz, 0 to 3800 ohms from 6 to 100 MHz
    Unknown inductive and capacitive reactance range: 0 to 360 ohms at 1 MHz, 0 to 1800 ohms at 4 MHz, 0 to 1900 ohms from 6 to 100 MHz
Resistance Dial Range: 0 to 250 ohms
Reactance Dial Range: − 150 to + 150 pF

Table I– Specifications for the MFJ-202B r.f. noise bridge.

tinuously, so by the very nature of the device, this means it can be used for adjustments on any of the new WARC bands. The unknown resistance range remains constant from 1 to 100 MHz at 0 to 250 ohms. The unknown inductive and capacitive reactance range, on the other hand, is very much frequency dependent because the reactance of the standards themselves used in the noise bridge are frequency dependent. This is a completely normal situation, although it has not always been recognized by many users of the noise bridges. The MFJ-202B X_C and X_L unknown values as shown on the front-panel calibrated **Reactance** control represent only the reactance dial range reading and not the actual value of an unknown reactance at a given frequency. How actual values are found will be explained shortly. In any case, the basic unknown inductive and capacitive reactive range of the MFJ-202B covers a very useful range, but its basic range is greatly enhanced by a "Range Expander" feature. The use of the feature allows unknown reactances up to several thousand ohms to be measured in the h.f. range. In practical terms this means that various transmission-line and antenna impedances which most noise bridges cannot handle are within the range of the MFJ-202B.

The circuitry of the bridge is shown in fig. 2. A 1N753 zener diode is the actual broadband noise source, and the noise output produced by it is amplified by three successive 2N3904 wideband amplifier stages. T1 is a carefully balanced broadband transformer wound on a ferrite toroid core. The balance of the secondary winding centertap is particularly important. The 250 ohm variable resistor represents the front-panel **Resistance** control on the MFJ-202B. The 10–300 pF variable capacitor going to the Range Expander in/out switch represents the "trick" idea that allows the 10–300 pF variable capacitor to have both an X_L and X_C range function. The Range Expander function is achieved by having a 200 ohm fixed resistor switched in parallel with the impedance connected across the "unknown" terminals. The basic effect of the insertion of this resistor is to enhance the effect of the variable 250 ohm resistor used for resistive impedance settings and the effect of the 10–300 pF variable capacitor used for inductive/capacitive settings. The enhanced effects are quite dramatic in that both the resistance and reactance ranges are increased to several thousand ohms, as shown in detail in Table I. This means that the high impedances such as those found on the terminals of a half-wave antenna or at the end of the various transmission-line transformers can be measured with the MFJ-202B.



A look inside the MFJ-202B. All the circuitry is on a single pc board, and SO-239 (u.h.f.) connectors are used for the "unknown" and "receiver" connections.

The circuitry components, except for the variable resistor and capacitor elements, are all mounted on a single pc board. The construction of the unit is very neatly done, and it is housed in a two-tone enclosure measuring about 4½" × 4½" × 2¼". It is powered by an internally mounted 9 volt battery. The current drain is about 17 ma, so an alkaline-type battery would be a good choice if one were going to use the bridge continuously for a few hours.

Applications of the MFJ-202B

Using the bridge first of all requires that one understands the functions of the front-panel controls. The **Resistance** control has lettered settings from **A** to **G** rather than a numerical scale. This is because each unit is individually

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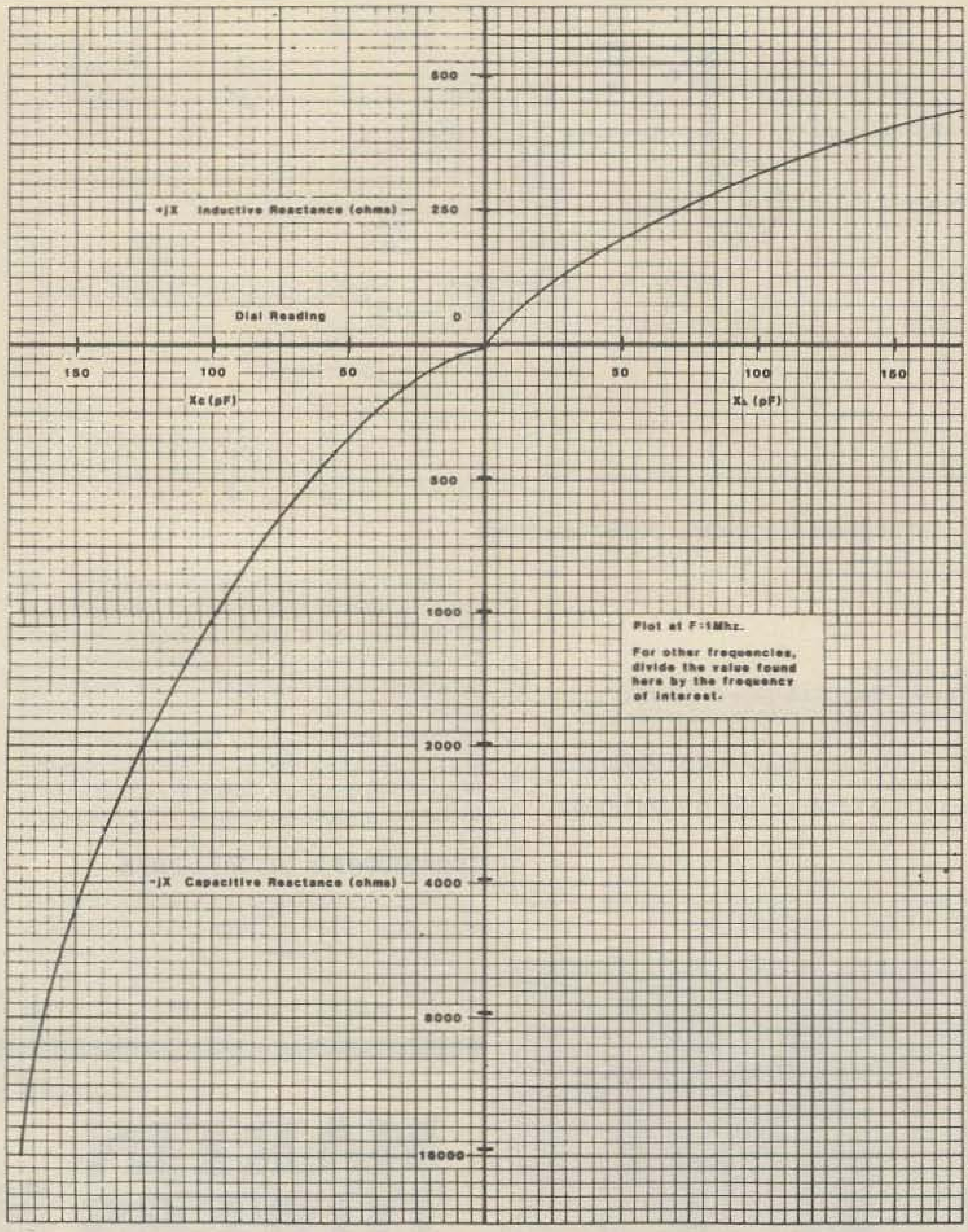

Fig. 3– The graph (in reduced size) which must be used with the 202B to find reactance at a given measurement frequency.

calibrated, and a resistance calibration scale is attached on the underside of the unit. In the unit tested the calibration scale showed **A** to represent 0 ohms, **B** to represent 28 ohms, **C** to represent 74 ohms, etc., up to **G** being 238 ohms. The **Reactance** control has settings of ± 150. When using the bridge without its Expander feature, one takes the reading on the reactance control scale and then uses the graph shown in fig. 3 to find the actual reactance at the frequency of interest. The resistance reading is taken directly from the resistance calibration scale supplied with each unit. If the Expander function is used, both the actual resistance and reactance values have to be found using equations which are found in the instruction manual for the unit using, of course, the dial readings. The equations are simple ones which can be performed on any basic pocket calculator.

Speaking of the instruction manual, it must be mentioned that it is the best one I have seen yet for a noise bridge. It first gives a clear summary of the operating instructions for the bridge. It then goes on to illustrate a wide range of uses for the bridge, for instance:

1. How to find the resonant frequency of an antenna.

2. How to measure antenna impedance at the antenna terminals.

3. How to measure the impedance of an antenna system at the feedline end.

4. How to cut a half-wave dipole to resonance.

5. How to find the exact resonant frequency of a series- or parallel-tuned circuit.

6. How to tune a transmatch and synthesize r.f. impedances.

7. How to measure the input and output impedance of an r.f. amplifier.

8. How to measure the impedance of r.f. transformers and baluns.

9. How to accurately cut feedline to quarter-wave or half-wave lengths.

10. How to measure inductance and capacitance component values (using a 100 pF capacitor and a 5 μH inductor as standards to form resonant circuits).

The beauty of a noise bridge is nicely illustrated by just one of the applications mentioned above: cutting a half-wave antenna to resonance. Normally one would do this with either a grid-dip meter or using an s.w.r. meter. Using the grid-dip meter method one either has to accept the crude frequency calibration of such a device or constantly check its calibration with a receiver. Using the s.w.r. meter method, one has to apply power to the antenna and then guess whether it should be made longer or shorter, unless one is willing to vary the transmitter frequency up and down and create unnecessary QRM. Using the noise-bridge method, one connects the unknown terminals of the bridge to the antenna terminals (or to the terminals of a half-wave transmission-line section, or multiple thereof, feeding the antenna) and directly measures the resistive and reactive impedance components at the *exact* frequency at which the dipole should be resonant. If inductive reactance, X_L, is measured, the antenna has to be shortened, and if capacitive reactance, X_C, is measured, the antenna has to be lengthened. One can perform the task at leisure without worrying about things such as transmitter loading and tuning, grid-dip meter idiosyncrasies, creating QRM, etc.

A similar situation exists when one considers the use of a noise bridge versus a grid-dip meter for performing almost any of the applications just mentioned. And when it comes to an application such as presetting an antenna tuner to match an antenna system to the 50 ohm output of a transmitter without applying transmitter power, the grid-dip meter is totally useless. The only disadvantage of the noise bridge as a test instrument is that it must be used with a receiver. For field applications this does pose some problems, although of an increasingly insignificant nature, since general-coverage, portable h.f. receivers with digital frequency readouts are becoming available in the $100 range.

Experiences Using the MFJ-202B

The bridge was first tried using a 50 ohm dummy load and a receiver tuned to a 14 MHz frequency. The **Resistance** control on the bridge produced a null halfway between the **B** and **C** dial markings, which, using the calibration chart supplied with the unit, translated to 51 ohms! However, the **Reactance** control could not be set to produce a null. It turned out that the very nicely done baked paint finish on the front panel of the bridge was too good. The variable capacitor did not have its rotor grounded. After that slight fault was corrected, the reactance control produced a null at exactly the zero marking on the dial scale.

The bridge was then checked with different impedance loads throughout the h.f. range, and it performed without fault. The noise signal usually ran about S9 plus 20 dB and could be nulled down to S1 – 3, depending on the type of load used. Unless one can disable the a.g.c. on the receiver being used, it should be noted that the bridge controls must be adjusted *slowly* to obtain a good null. Also, reducing the r.f. gain control on a receiver so the noise-bridge output doesn't overload the receiver will help to produce more easily discernable nulls. When using the bridge to preset an antenna tuner to load a transceiver, the resulting s.w.r., once power was applied, was less than 1:1.5 on every h.f. band.

Overall, the MFJ-202B is an excellent instrument, but one shouldn't be tempted, even as MFJ notes in the manual for the bridge, to use it for absolutely precision measurements. It will, however, produce *vastly* more accurate impedance measurements than is possible with any other test instrument normally found in a ham shack, and its convenience cannot be beat. It carries a 12-month warranty and is sold under the MFJ 30-day return guarantee.

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The first official volunteer-administered amateur radio examinations were given on 17 April 1984 by KL7LK, KL7HFQ, and KL7CQ, "World's First Volunteer Examiners." All three are members of the Anchorage Radio Club, the Volunteer Examination Coordinator (VEC) for the KL7 District.

Following on the heels of this success, says John Johnston, Special Services Division, Private Radio Bureau, FCC, was the administration of 350 exams by members of the Dayton Amateur Radio Association (DARA). DARA is the 8th District's VEC, and the exams were given as part of the 1984 Dayton Hamvention.

Finally, from Chicago comes word that the DeVry Amateur Radio Society, the 9th District's VEC, has started to give exams in that city on a weekly basis. Contact the Society for details.

According to Johnston, all three VECs plan to expand their examination activities throughout their districts during the coming months.

In commenting on the initial administration of exams under the volunteer program, Senator Barry Goldwater (Congressional Record, Senate, 3 May 1984) stated:

"Across the entire country, other volunteers are preparing to administer the amateur technical and Morse code examinations. Even as this occurs, the FCC has announced that they will have completely phased out their own testing by the end of 1984.

"As a radio amateur myself, I am proud to report these events to my fellow Senators. The radio amateurs of this Nation are once again demonstrating their dedication and abilities. The taxpayers benefit by not picking up the tab for amateur examinations, and the amateurs benefit by having examinations more readily available and a more direct role in the Amateur service."

ARRL Files in Support of VEC Cost Recoupment

As reported in *The ARRL Letter*, the League has filed comments with the Commission supporting proposals to amend the Amateur Rules "to allow reimbursement of out-of-pocket expenses incurred by both Volunteer Examiners and Volunteer Examiner Coordinators." The comments were in response to the Notice of Proposed Rulemaking proposals contained in Personal Radio Bureau Docket 84-265.

In supporting its position, the League noted that the rule changes proposed simply implemented provisions of the Federal Communications Commission Authorization Act of 1983. Statements made on the floor of the Senate by Senator Barry Goldwater, which supported cost-recovery provisions similar to those in the Notice, were also cited.

The Notice does not address how any funds collected are to be divided among VECs and VEs. However, it is apparently the League's belief that the method of dividing reimbursement funds should be a matter of discussion between a VEC and its VEs.

Once the Commission permits the recoupment of costs incurred by VECs (up to the limits provided for in the Notice), it is likely that the League will file application to become a VEC in all 13 districts.

In a related action, Joe Schroeder, W9JUV, filed comments on the Notice to address the problem that a VEC may "profiteer" in its participation in the cost recoupment program. To this end, Schroeder requested that the Commission require VECs to justify their charges using proper accounting procedures. He also suggested that VECs be required to file an "Examination Fee Schedule" and the justification used in setting its fees.

R.F.I. Complaints Again on the Rise

According to Jeffrey Young, Enforcement Division, Field Operations Bureau (FOB), FCC, RFI complaints to the Commission in the second quarter of FY-84 (January, February, and March 1984) totaled 18,919, up from the 17,860 complaints reported in the same period a year earlier. This means that after a dip in the number of complaints received in 1983, reported RFI cases are again running in excess of 75,000 per year!

Of the 18,919 complaints received, 14,748 (78%) involved a television receiver as the victim device. Of these, CB operations were alleged to be involved in 9,725 cases of TVI, while amateurs were cited in 739 cases. The continued high level of TVI complaints—due, in most cases, to front-end overload of the TV set—indicates that TV manufacturers still have not corrected the design deficiences responsible for the alleged "interference."

In all, CBers were alleged to be involved in 10,963 complaints, while amateurs accounted for 1,163. Complaints by amateurs against other amateurs totaled 384, about the same as the number reported in the year-earlier period.

As has been reported here, the Commission continues to watch with concern those RFI complaints resulting from the operation of so-called "Part 15" devices (i.e., devices that are not intended to radiate, but do). In the second quarter of fiscal 1984, 1,539 cases of interference from Part 15 devices were brought to the Commission's attention, many resulting from touch-sensitive switches and power lines. Cable television interference (CATVI), too, is another area being watched carefully. In the second quarter, CATVI systems were cited in 418 cases of interference to other communication systems, while only 41 interference complaints were filed by CATV viewers.

Readers experiencing RFI problems are urged to file complaints with the FCC: Federal Communications Commission, Attn: Field Operations Bureau, 1919 M St., NW, Washington, DC 20554.

FCC Continues To Act Against Amateur Violators

Reports of malicious interference to communications on San Diego area amateur repeaters has brought swift action on the part of that city's FCC field office. As a result of its continuing investigation into such violations, the Commission has ordered three San Diego area amateurs to "show cause" why their amateur licenses should not be revoked. Named in Commission revocation proceedings were Calvin C. Plageman, WD6DSV; James W. Smith, W6VCE; and Anthony DiBona, K6PWX. All three respondents are charged with violating Section 97.125 (willful or malicious interference). In addi-

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tion, Smith and DiBona are charged with violating Sections 97.84(a) and 97.123 (failure to identify); 97.113 (broadcasting); and 97.115 (transmission of music).

At this writing, investigations on interference to repeater operations are continuing, and it is expected that the Commission will initiate additional revocation proceedings against other amateurs in the near future.

Amateur Forced To Give Up License For Four Months

As reported by the Commission, Edward Johnson, WA2JHU, of Syracuse, NY, has paid a $600 fine and has agreed to turn in his amateur license for a period of four months. The actions were taken as a result of an investigation by Onondaga County (NY) police into complaints of severe interference to amateur communications during the 1983 Empire State Games in Syracuse. Specifically, Captain David A. Stevenson of the Onondaga County Sheriff's Department traced the source of the interference to Johnson, who was cited for failure to identify his transmissions (Section 97.84) and for broadcasting (Section 97.113).

SRI International To Attempt Revival of UO-11

When the 2 meter beacon in UoSAT OSCAR 11 went silent shortly after the satellite was launched, noise in the beacon, presumably generated by a power regulator, prevented further commanding of the bird. Hopes that a "watchdog timer" would eventually turn the beacon off were dashed when the time period over which the timer was expected to operate passed without any observable change in the satellite's behavior. Now, *Amateur Satellite Report,* AMSAT's newsletter for the amateur space program, has announced that arrangements have been made with SRI International of Menlo Park, California, to use its large L-band station to first locate UO-11, to determine whether the bird is "brain dead," and finally to command the 2 meter beacon off. If SRI International is successful in its efforts, controllers at Surrey, England, will begin anew to bring UO-11 on stream for amateur communications.

The attempts by SRI International to localize and command UO-11 will be led by Dr. Robert Leonard, KD6DG, Director of SRI's Radio Physics Laboratory. Readers will recall that it was Dr. Leonard and his SRI team who rescued UO-9 two years ago when that satellite too was rendered deaf for a period of several months.

November 1984 FCC Exams To Be the Last

According to Richard Smith, Chief, Field Operations Bureau, examinations scheduled to be held in FCC offices this November will be the last. It is the Commission's expectation, says Smith, that by that time the Volunteer Examination Program will be fully operation.

The switch to examinations administered by volunteers, however, does not eliminate the possibility that the Commission may choose, on a case-by-case basis, to conduct tests. Such examinations would ordinarily be done at the convenience of the Commission in cases in which fraud was suspected.

ARRL Active in a Number of Rulemaking Areas

Earlier this year the ARRL filed comments with the FCC on a number of issues pending before the Commission. These issues included:

1. Personal Radio Docket No. 82-83, to expand the phone segments in the 75, 15, and 10 meter bands. The League's latest filing, a Motion for Expedited Action, noted, among other things, that almost two years have passed since the proceeding was initiated!
2. General Docket No. 84-186, to amend the Rules to make 2310–2390 MHz available to flight-test telemetry stations. The League's comments expressed the desire to retain the Amateur service's Secondary allocation in this band.
3. Early implementation of the Amateur service allocations in the bands 24.89–24.99 and 902–928 MHz.

The results of any Commission decisions will be reported in this column as they become available.

Prankster Injects His Own Transmission Into Pay-TV Service

As if the FCC didn't have enough problems these days, a prankster has added a new dimension to the words "intentional interference." According to Thomas Heinen of *The Milwaukee Journal,* a local pay-TV operator and the FCC are stalking one or more persons who used an illegal transmitter to interrupt Home Box Office programs with bogus messages. The messages included the image and voice of a disguised man, and textual messages which were accompanied by a computer-synthesized voice. The mystery transmissions appear to be in protest to the pay-TV operator's prosecution of people who use unauthorized equipment to receive its transmissions, since the disguised man, according to the *Journal,* "told viewers that it was permissible to use privately purchased receivers or receiver kits to view . . . programs as long as the operation of the equipment was for the viewers' own personal enjoyment."

Officials of the pay-TV operation know how the intruder was able to inject his signals into their system, but declined to release additional information pending apprehension of the prankster. They did say, however, that whoever was involved in the prank must be a "fairly sophisticated" electronics experimenter.

Dennis R. Patrick Confirmed As FCC Commissioner

After having served as a "recess appointee" since early December 1983, Dennis R. Patrick was confirmed on March 30, 1984 as a Commissioner of the FCC. Previously, Patrick had practiced law in Los Angeles, California (1976–1981), and had served in the Office of Presidential Personnel, the White House (1981–1983).

Your Washington editor extends his appreciation to Mr. Dave Siddall, K3ZJ, for his contributions to this month's column.

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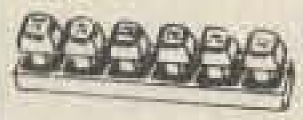

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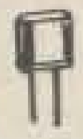

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MRF426A*	25W	17.00	40.00
MRF433	13W	14.50	32.00
MRF435*	150W	42.00	90.00
MRF449	30W	12.00	27.00
MRF449A	30W	11.00	25.00
MRF450	50W	12.00	27.00
MRF450A	50W	12.00	27.00
MRF453	60W	15.00	33.00
MRF453A	60W	15.00	33.00
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Amateur-Wholesale EXL-5000 Digital Communications Terminal

The EXL-5000 digital communications terminal features a built-in, high-resolution, long-persistence green monitor for sharp, clear images with no jiggle or jitter even under fluorescent lighting. Also featured are an external plug-in keyboard and a built-in power supply for 117/234 v.a.c. or 13.8 v.d.c. Operation is simplified by front-panel pushbutton controls. The EXL-5000 includes capability for operating in the new Amtor modes A, B, and L. A high-speed demodulator allows Baudot and ASCII operation from 12 to 300 bauds with AFSK and 12 to 600 bauds at TTL level, in increments of 0.1 baud. The demodulator will work with high or low tones. For transmitting, AFSK or FSK keying can be used. Morse sending and receiving speed is adjustable from 5 to 100 w.p.m. in 1 w.p.m. steps.

A 1280 character display memory is split into two pages of 40 characters by 16 lines. Seven independently programmable 72-character channels and five independently programmable 14-character channels allow storage of messages for permanent use. The memories can be preloaded and reprogrammed. Errors are easily corrected. The programmable memories are backed up by an internal battery so that they are never lost. For more information, contact Amateur-Wholesale Electronics, Inc., 8817 S.W. 129th Terrace, Miami, FL 33176, or circle number 101 on the reader service card.

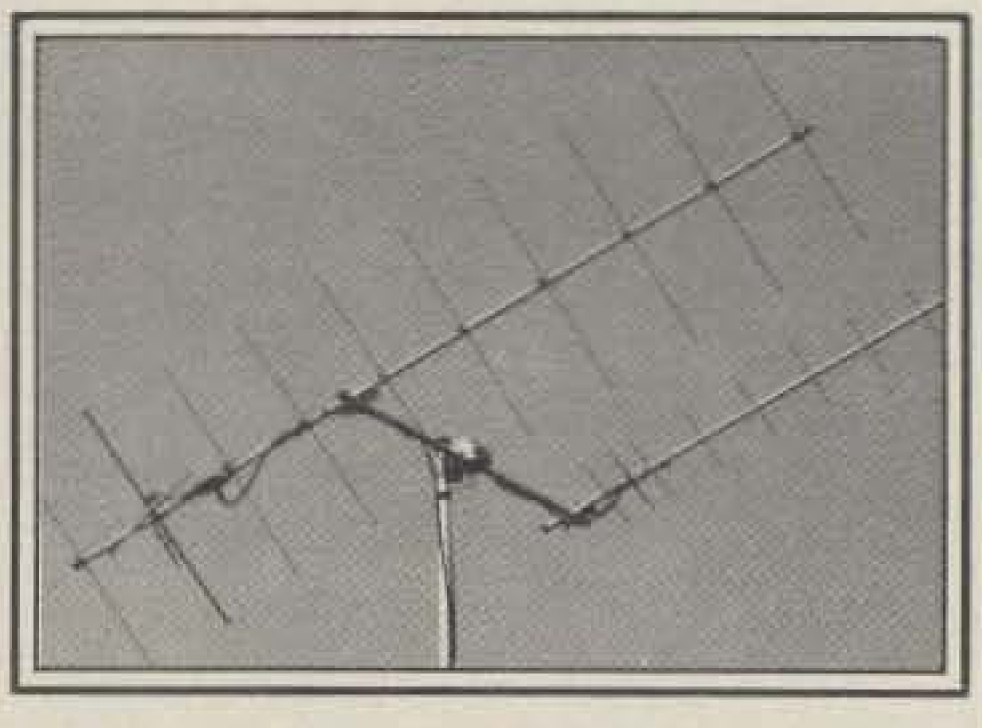
Mirage HT Amplifiers

The B23A (144–148 MHz) and C22A (220–225 MHz) HT amplifiers from Mirage Communications feature a built-in receive preamp that delivers a 1.5–2.0 dB noise figure, all-mode operation (c.w., f.m., or s.s.b.), and automatic antenna changeover. The r.f. power input range from 100 mw to 5 watts, and high r.f. power output (B23A, 2w in = 20w out; C22A, 2w in = 30w out), makes them compatible for use with virtually all low-power transmitters.

The B23A and C22A are backed by a five-year factory warranty (one year on r.f. power transistors). In addition to the B23A and C22A Mirage manufactures a complete line of dual-purpose power amplifiers for 50–52, 144–148, 220–225, and 430–450 MHz frequency ranges. Suggested retail price of the B23A is $89.95 and C22A $89.95. For more information contact Mirage Communications, P.O. Box 1000, Morgan Hill, CA 95037, or circle number 106 on the reader service card.

Cushcraft Satellite Antenna

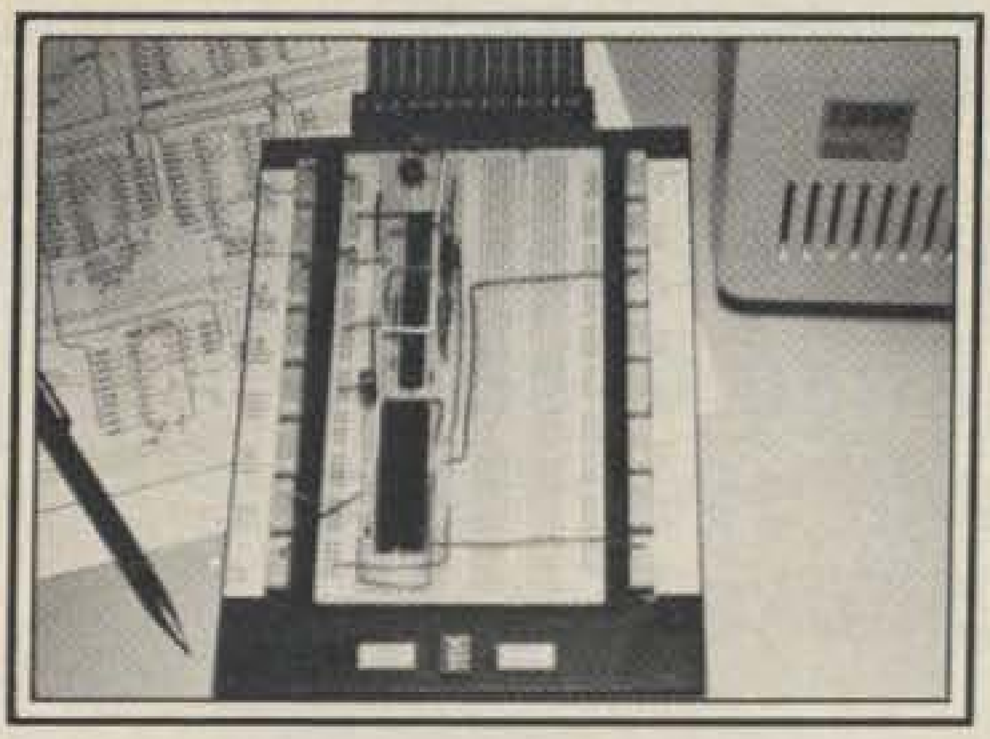
Cushcraft has introduced a new complete amateur satellite antenna system, the AOP-1, which features two high-gain circularly polarized Yagi antennas. The 70 cm 16-element uplink and 2 meter 20-element downlink antennas are fixed to a common mounting boom. The entire array is lightweight with reasonable dimensions for quick installation.



Price of the AOP-1 satellite antenna system is $199.95. For more information, contact Cushcraft Corporation, P.O. Box 4680, Manchester, NH 03108, or circle number 104 on the reader service card.

Sabadia Export Corp. Computer Prototyping Board

The "eZ Board" is a solderless experimenter system which provides a time-



saving and convenient method for building experimental add-ons to interface with personal computers. Features include a high-quality, glass epoxy printed circuit board mounted with a set of solderless breadboarding units for building circuits. Four separate distribution buses with 50 tie-points each can be used for power, ground, clock lines, reset commands, and more. A four-position dip switch is mounted on the board. Each switch position connects to a set of tie-point block sockets on either side to aid in the development and analysis of experimental circuits.

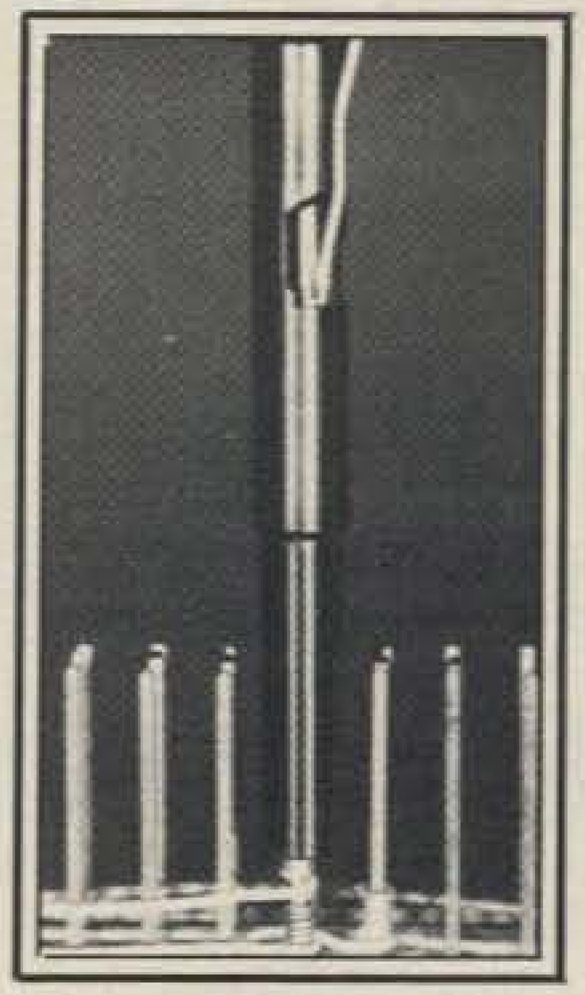
The breadboarding area consists of 1460 tie-points with a capacity of sixteen 14-pin dips. Components with lead diameters up to .032 simply plug-in and are connected with ordinary solid hookup wire. Models IPC, APC, and CPC are available for IBM-PC, Apple, and Commodore, and all other hardware-compatible computers of the same type. Models for other computers will be introduced during 1984. Retail price for the entire system, including cable and connectors, is $174.95 each plus $5.00 shipping. For further information, contact S.E. Corp., P.O. Box 1132, Yorba Linda, CA 92686, or circle number 102 on the reader service card.

ICOM IC-37A 220 MHz Mobile

The ICOM IC-37A 220 MHz compact mobile transceiver features 25 watts/5 watts low, 32 PL frequencies standard built-in, 9 memories with offset and PL storage, 10 kHz/5 kHz dial steps, memory scan, band scan, and priority scan, dual v.f.o.'s, and standard HM-23 Touchtone® and scanning mic. A speech synthesizer is available as an option. The IC-37A is 5½"W × 1½"H × 7"D. For more information, contact ICOM America, Inc., 2112 116th Ave., N.E., Bellevue, WA 98004, or circle number 105 on the reader service card.

OK Industries Inc. "CSW" Bit and Sleeve Sets

The O.K. Industries "CSW" bit and sleeve sets eliminate the need for pre-cutting or pre-stripping the wire prior to wrapping. The tools cut off the excess wire from cable, wire harness, or reel; strip the proper length of insulation, and wrap the correct number of turns all automatically. Used exactly like conventional bits and sleeves, the "CSW" sets require no special training. The bits are available for 24 AWG (0,50 mm), 26 AWG (0,40 mm) and 30 AWG (0,25 mm), and for a wide range of terminal sizes. For more information, contact O.K. Industries Inc., 3455 Conner Street, Bronx, NY 10475, or circle number 103 on the reader service card.



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Discover this durably built, feature packed MB-V Antenna tuner. You'll find operating conveniences that make antenna tuning a snap. The MB-V is value engineered to do the job over wide operating ranges. Compare quality, features and the exclusive NYE VIKING TWO YEAR WARRANTY!

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Please send all reader inquiries directly.

At last, a no-work antenna construction project that literally anyone can duplicate. This one will even "keep" a few bucks in your pocket.

Retaining The Magnetic Characteristics Of Mobile Antenna Mounts

BY CARL S. ZELICH*, AA4MI

Each morning and evening the Kennedy Space Center "Salt mine" net meets on our local 146.28/88 repeater. While enjoying a round table, John, WB4ZXS, was enlightening the net on the joys of owning a sports car. In midsentence his signal abruptly ceased. Further attempts to reach him failed. Was he in an accident? Where? Later a landline call to his office revealed that his magnetic 2 meter mobile antenna had fallen off his trunk. Dragging it at 55 mph, only a few parts were retrievable, and even less were recognizable. I know that this has happened to other amateurs. Tales of other antennas being dragged to their deaths came forth. The conclusion was to spend $50 and hope the magnet holds—this time.

Analysis of the problem revealed that most amateur radio operators regularly remove the magnetic mount and toss it onto the floor behind the driver's seat. This detrimentally affects the magnet in two ways. First, the antenna base eventually gets dropped onto the floor. As time passes, the drop height gets higher and higher—unintentionally, of course. This is not proper handling of a magnet. Magnets that are struck with a hammer will lose their magnetism. This repeated dropping contributes to disorienting the internal magnetic bipolar elements, and thus the magnetic flux strength declines. Second, when a magnet—even a so-called "permanent" magnet—is left lying around without a "keeper," the magnetic flux lines reach out to grasp other ferrous materials. A "keeper" is generally a soft iron piece which provides a bridge between the poles for the flux lines to follow. This convenient path allows the magnetic lines to concentrate and confine themselves to the keeper.

The solution to both these problems is simple. In the electrical section of your hardware store are metal, ceiling electrical boxes. They are available in square, octagonal, and round shapes. These are often called "breakout" boxes because a main supply line is broken to serve a branch line. Purchase a round, steel electrical box cover. The cover normally has a diameter of 3½ inches and is fine for all antenna mounts. Place this keeper onto your magnet before putting the antenna mount onto the floor. This keeper lessens the damage done if the antenna is accidentally dropped there. The keeper can also be kept on the floor or seat behind the driver when the antenna is on the vehicle. Also, this keeper should be in place whenever you plan to store your antenna for any length of time.

For about 41 cents for a keeper you will avoid spending another $50 for a new antenna! And best of all, there's no work involved! CQ

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MACAW DPM-1 SWR & POWER METER **$59.95**
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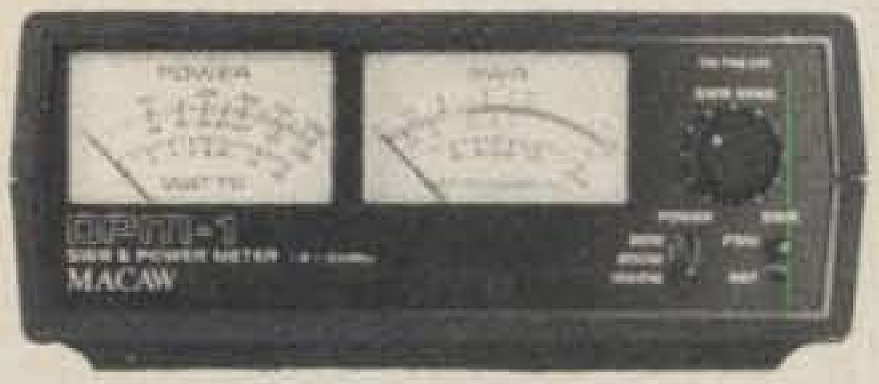

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SPECIFICATIONS

Frequency Coverage:	1.8-30.0 MHz continuous	Wattmeter:	Two separate meters, selectable for 2000 or 200 watts forward power, 200 watts reflected power
Input Impedance:	50 ohms Resistive	Wattmeter Accuracy:	+ - 10% of full scale
Outputs:	Coax 1 - S0239 Coax 2 - S0239 Dummy Load - S0239 Wire Antenna - High voltage feed thru Balanced - 2 High voltage feed thru	VSWR Protection Circuit:	Shuts off keying to amplifier at adjustable threshold of reflected power.
Inductance Format:	Precision roller inductor	Balun:	Built in 4:1, four core stack
Matching Range:	Unbalanced - at least 30 to 2000 ohms Balanced - 50 to 750 ohms	Bypass Provision:	Bypass to any output when A.C. power is applied to unit, bypasses to separate output when AC power is removed.
Power Capability:	2000 watts of S.S.B. R.F., 1000 watts continuous duty R.F.	Dimensions:	5.5" High, 14.2" Wide, 14.0" Deep
		Styling:	To match Dentron's MLA series of equipment

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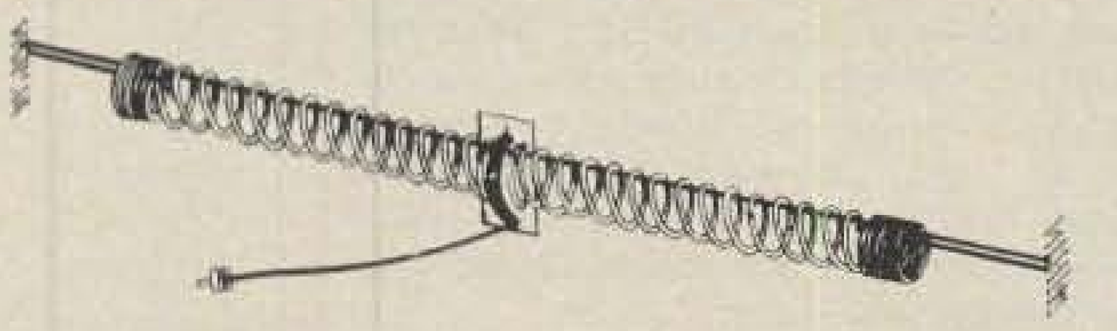
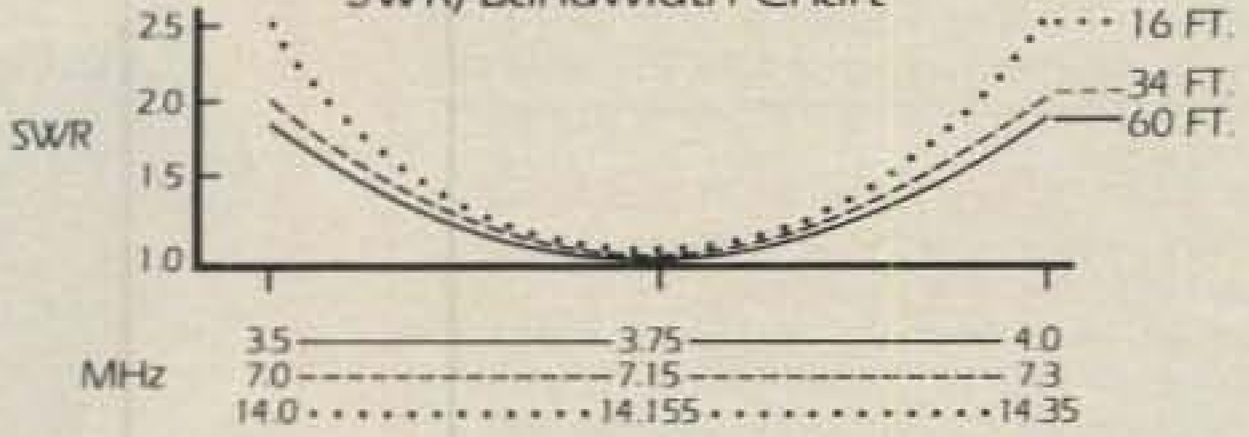
CIRCLE 9 ON READER SERVICE CARD

The SLINKY DIPOLE® Antenna



Put a full performance dipole in a small space. Don't let space or antenna restrictions slow down your ham fun. Get an 80-meter dipole in as little as 24', similar space saving on all HF bands, 80 through 10. The Slinky Dipole antenna is continuously adjustable for all HF bands, including the new WARC bands. No extra parts or add-ons to buy. Easy to set up and adjust. Goes together in less than an hour. Use it indoors or out, in apartments and attics where it's unseen and out of the way.



Use the antenna two ways: adjust it for each band, or set up for lowest frequency band you operate and use a tuner. Works well either way. You get a complete kit: 2 special spring coils, balun form, end clips, rope, 50' of RG-58/AU co-ax, connector, instructions & tuning charts. Add-on kits available for 160 M. Call or write for data sheet. VISA/MC welcomed. $67.95 postpaid (USA). VA residents add 4% sales tax.

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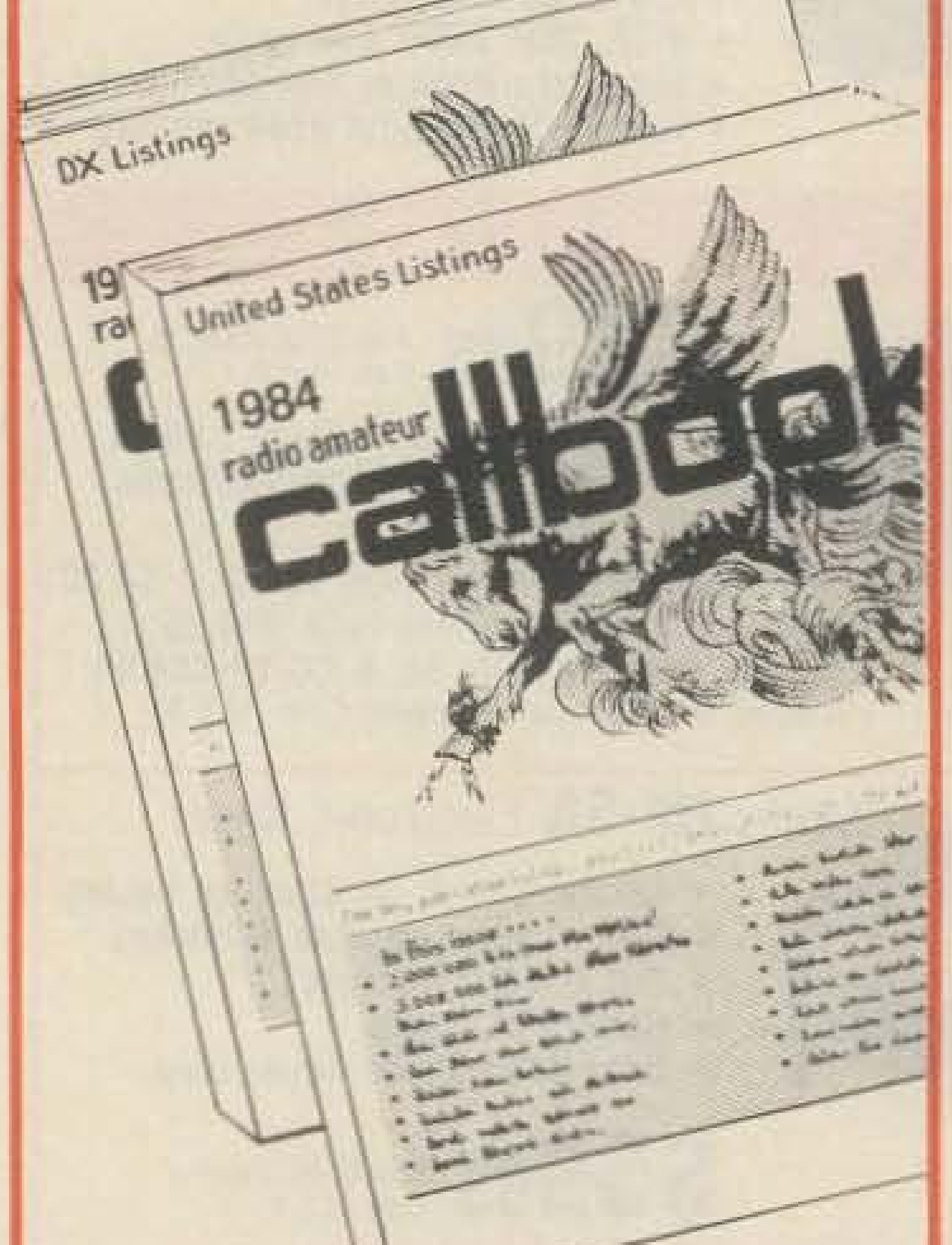

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1984 CQ WW WPX S.S.B. Contest High-Claimed Scores

The following scores are early-bird high-claimed scores as of 29 May 1984. These are raw scores subject to verification.

U.S.A.
SINGLE OPERATOR ALL BAND

K2VV	3,390,016
KC1F	3,218,418
KR0Y	3,193,385
AI6V	2,673,248
K6HNZ	2,284,512
AF5K	2,180,420
K5RX	1,688,852
K5MR	1,668,544
N7TT	1,488,027
WI4R	1,468,092
AI2C/4	1,405,536
WC4E	1,248,160
KF2O	1,190,646
AI8S	1,117,656
KG4W	1,013,430
KV9S	957,456
KI6O	897,066
W7FP	877,256
K6EID	826,735
K6SG	704,506
N8BJQ	664,578
WI4K	564,400

28 MHz

KN5H	932,516
NU4Y	822,000
NA5S	689,734
WB7FDQ	372,064
KM9P	175,449
ND0E	147,312
WB7RFA	94,122
AC3T	74,227
AB0X	55,650
WB4VQO	45,313

21 MHz

NA5R	1,683,190
N2AU	1,603,166
WA6DBC	1,402,170
KG5U	988,025
N6AW	953,146
KM5K	863,968
WB6FCR	761,852
K1TR	752,350
KQ9L	587,697
KZ8Y	417,834

14 MHz

WA0TKJ	615,150
W5FO	536,833
KE5CK	425,880
KA5W	219,726
WA5IGD	170,544
W5VGX	93,732
KR9G	87,776
WA3DMH	85,140
N9EJL	84,356
AA1M	47,680

7 MHz

KI6P	1,158,606
K9MWM/0	369,180
AB7L/9	326,032
WB5YLT	25,530
WD4DII	13,640
W4MGX	3,744

3.8 MHz

N7DF/0	149,340
KJ9D	125,984
KM5R	124,500
N4OH	120,934
KU8E	105,076
KQ3V	76,384
W8IMZ	50,652
W3ICM	23,232
K0CS	19,584
K7GWK	19,404

1.8 MHz

WB3GCG	45,792
N4SF	18,832
KC8JH	17,082
AA4MM	15,554
KE2C	9,204
N7CKD	2,728
KA7AUH	2,640
KU8V	1,748

MULTI-SINGLE

N5AU	6,304,254
W7RM	5,826,002
KW8N	3,229,434
AK6A	2,689,792
NO4J	2,539,936
KY0S	2,377,580
KY2P	2,164,132
KI2P	1,920,303
KZ2E	1,548,018
KS9O	1,439,289

MULTI-MULTI

NG5X	7,526,122
NM5L	6,100,920

QRPp

KH6CP/3	A	176,436
W6CN	28	29,997
W6YMH	21	28,910
N7NV	3.8	690

DX
SINGLE OPERATOR ALL BAND

VK2WU	5,940,144
K3ZO/HK3	5,064,329
ZS1CT	4,462,935
LU1BR	4,262,680
KG6DX	3,399,936
PP2ZDD	3,197,852
CE3DNP	2,450,085
JH7DNO	2,247,000
KL7Y	1,702,552
J41JG	1,667,576
OK3CSC	1,574,208
HH2WL	1,559,767
CQ6UA	1,491,658
LZ1QV	1,077,205
VE3LDT	997,512
OK1ARI	945,928
I6NOA	926,394
CE4EBJ	883,784
OK2BTI	876,104
ZP5JCY	850,509
HI8GB	807,666
OK2RU	738,088
TI5MRC	711,621
HA8UB	690,468
HA5KDB	677,236

28 MHz

CE6EZ	5,437,936
LU4DM	2,788,524
PY5BAB	2,557,632
ZY5IW	1,746,936
ZY2FZ	1,676,682
LU2HAO	1,557,626
ZL1ANJ	1,276,882
WA4EMA/KP2	1,213,632
VE1YX	1,057,298
CE3DKZ	1,028,435

21 MHz

CX7BY	2,944,474
P42J	2,323,953
OH6AM	2,232,940
5B4MF	2,193,303
KP4EQF	2,157,918
JR1WHW	1,556,256
DF8XC	1,097,341
4Z4TR	1,055,774
PA3CEF	765,135
ZY5AAT	579,740

14 MHz

FO8JP	3,216,408
G3FXB	2,340,403
SM2EKM	1,913,457
WP4AOH	1,477,952
SM2CEW	1,454,227
DL8PC	1,357,065
OH1AF	1,322,288
VE3EEW	1,288,050
HI3EMS	1,207,200
ZL0AAJ	934,912

7 MHz

T32AF	2,990,624
VE3BMV	2,842,464
VO1CV	2,465,850
YU7AD	1,582,098
OH1RY	1,043,088
ZL4BO	835,354
JA5BJC	775,500
YV2IF	691,092
JA2BAY	510,448

3.5 MHz

4M3AZC	1,166,166
5B4LP	767,454
VE3IY	721,392
CK3IPR	583,596
HA8IE	330,218
VE3CRG	129,504
LA9PT	114,036
DL8MBS	104,940
OK2HI	90,432
VE7AO	61,408

1.8 MHz

EA9KF	264,100
VE3CDX	205,824
YU3EF	113,690
VE3MFA	91,200
IN3DYG	88,608
I5MXX	65,016
SP5INQ	61,056
SP3AGE	48,552
YV5JEA	40,320
VE3BBN	29,512

MULTI-SINGLE

ZZ5EG	14,269,557
KD7P/NH2	9,753,840
IO5BGM	8,653,824
NP4CC	8,252,905
VK3FY	5,464,689
F9IE	5,274,240
JG1ZUY	4,869,650
UK2RDX	4,549,860
VE6OU	4,378,659
JA9ZKE	4,353,741
GB0WAS	4,176,676
OH8AA	4,100,992
OK6DX	4,059,636
JH3YJM	3,302,692

MULTI-MULTI

VP2EC	17,650,590
KH6XX	11,366,688
KL7RA	6,883,884
CE3AA	2,986,812
W6QL/CE0	1,389,024

QRPp

H44R	A	1,576,608
NP4KA	28	310,134
SP1HJK	21	29,516
IK8BOK	14	31,200
SM5ARR	7	1,700
SP5FKW	3.5	9,638
OK1MP	1.8	7,040

Note: Queries pertaining to the WPX Contest should be sent to N8BJQ via *CQ* magazine, 76 N. Broadway, Hicksville, NY 11801.

Bencher 1:1 BALUN

- Lets your antenna radiate, not your coax
- Helps fight TVI—no ferrite core to saturate or re-radiate
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- May be used witn antenna tuners; rated 5KW peak
- Handles substantial mismatch at legal limit
- Built-in center insulator; Amphenol® coax connector
- Rugged UV resistant custom Cycolac® case, not plastic plumbing parts

ZA-1A $17.95
3.5-30 mHz

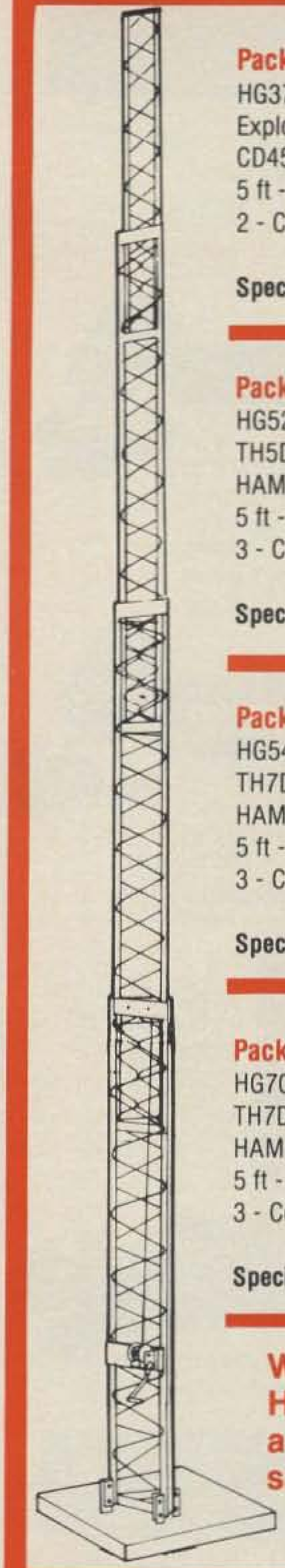
ZA-2A $21.95
14-30 mHz, with hardware for 2" boom

Available from your dealer. In U.S.A. add $2.00 handling

BENCHER, INC.
333 W. Lake St., Chicago, IL 60606
(312) 263-1808

CIRCLE 65 ON READER SERVICE CARD

HYGAIN TOWER/ANTENNA PACKAGE SALE!



Package #1

HG37SS 37 ft Tower	List $844
Explorer 14 Triband Antenna	List $453
CD45II Rotor	List $196
5 ft - 2 in. Diam Mast	List $52
2 - Coax Arms	List $26
	Total List $1571

Special Freight Paid Package Price $1249!

Package #2

HG52SS 52 ft Tower	List $1234
TH5DX Triband Antenna	List $575
HAM IV Rotor	List $303
5 ft - 2 in. Diam. Mast	List $52
3 - Coax Arms	List $39
	Total List $2203

Special Freight Paid Package Price $1749!

Package #3

HG54HD 54 ft Tower	List $1927
TH7DX Triband Antenna	List $665
HAM IV Rotor	List $303
5 ft - 2 in. Diam. Mast	List $52
3 - Coax Arms	List $39
	Total List $2986

Special Freight Paid Package Price $2399!

Package #4

HG70HD 70 ft Tower	List $3106
TH7DX Triband Antenna	List $665
HAM IV Rotor	List $303
5 ft - 2 in. Diam. Mast	List $52
3 - Coax Arms	List $39
	Total List $4165

Special Freight Paid Package Price $3399!

We can substitute other HyGain antennas, rotors and accessories at similar savings—Call today!

ROHN TOWER TRUCK LOAD SALE!

Save a bundle on your new Rohn Tower during our summer 1984 **Truck Load Tower Sale!**

Rohn Tower Co. will be expediting Tractor Trailer Loads of all popular models to Texas Towers during this special promotion—These high volume purchases will allow unprecedented savings on Rohn Towers and accessories!

Even Rohn's big **55G** model Tower is included in this special promotion!

Rohn Guyed Tower Kits

Height	25G Price	45G Price	55G Price
40 ft	$ 469	$ 839	$1049
50 ft	$ 519	$ 949	$1189
60 ft	$ 569	$1059	$1319
70 ft	$ 619	$1169	$1459
80 ft	$ 779	$1469	$1599
90 ft	$ 829	$1589	$1899
100 ft	$ 899	$1699	$2039
110 ft	$1089	$1819	$2189
120 ft	$1149	$1939	$2329

Above Tower Kits are **complete** with factory recommended accessories including Mid-Sections, Top Section, Base Assembly, Rotor Plate, Guy Brackets and Torque Bars, Guy anchors, Turnbuckles, Guy Wire and associated connection Hardware.

We can **substitute** items and/or **custom design** your system at similar savings. Just let us know what you need!

All above Guyed Towers are shipped Freight Collect F.O.B. our Dallas Texas warehouse.

See our antenna/accessory advertisement for prices on Phillystran© nonconducting guy material.

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(214) 422-7306

Store Hours: Mon-Fri: 9am - 5pm
Sat: 9am - 1pm

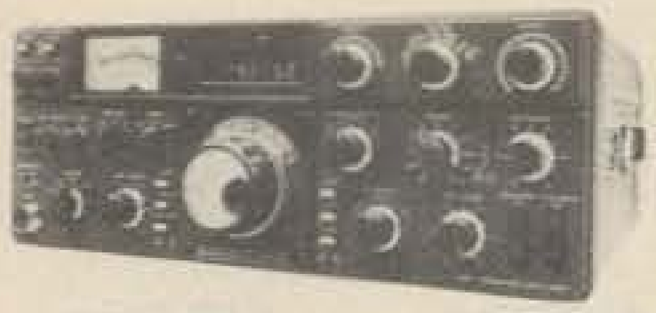
CIRCLE 2 ON READER SERVICE CARD

KENWOOD SPECIALS

ICOM SPECIALS

TS-930S
Plus 3 Bonus Items
- Antenna Tuner (factory installed)
- MC-60A Microphone
- SP-930 Speaker

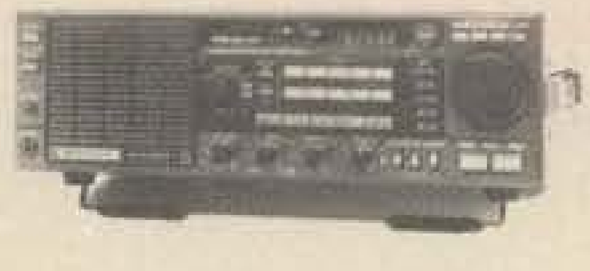
Regular $1958 Value
$1699.95



TS-530SP
With FREE MC-50 Mic
Regular $807 Value
$699.95 Save $107

TM-201/TM-401
Limited Quantity
Special Factory Price Reduction
Call For Special Price

TR-7950 List $429.95
Call For Special Price
TR-7930 Also On Sale!



R-600, R-1000, R-2000
List $399.95, $499.95, $599.95
HF Receivers In Stock
Call For Special Prices

TS-430S
List Price $899.95
Compact General-Coverage
Full-Feature HF Transceiver
Call For Special Low Price!

TW-4000A
With FREE VSI Voice Synthesizer and MA-4000 Dual-Band Antenna
Only $599.95 Save $85

TR-2500
With Free Heavy-Duty Spare NiCad and Free SMC-25 Speaker Mic
Regular $404.85
All For Only $329.95
Save $74.90!

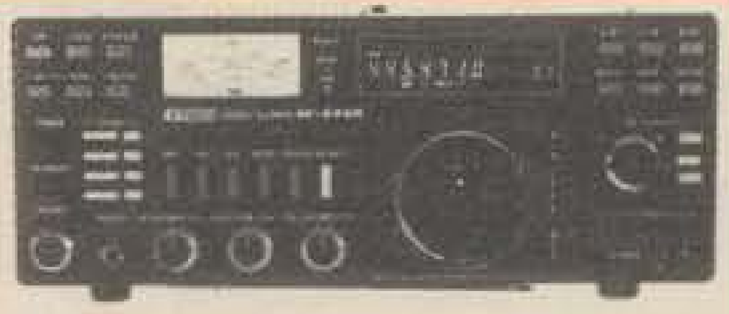
All-Mode VHF/UHF Oscar Transceiver
TR-9130 List $549.95
TR-9500 List $649.95
Call For Special Prices!

TS-780 List $999.95
Dual Bander In Stock
Call For Special Prices!

IC-751
Plus 2 Bonus Items
- PS-35 Internal AC Supply
- SM-6 Desk Microphone

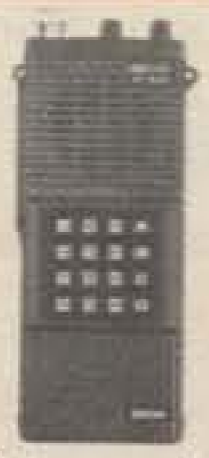
Regular $1598.50
$1399 Save $199.50

IC-27A, IC-27H, IC-37A, IC-47A
All Now Available
Call For Special Sale Prices! Save $$$!



IC-271A/H 2 mtrs
IC-471A 70 cm
Perfect Oscar Equipment
Call For Special Prices!

Repeaters
RP310 440 MHz $899
RP1210 1.2 GHz . . . . Call



IC-2AT $219
IC-3AT $239
IC-4AT $239

All Accessories in Stock!

BP2 Battery Pack	$39.50
BP3 Battery Pack	$29.50
BP4 Battery Case	$12.50
BP5 Battery Pack	$49.50
BC35 Base Charger	$69.00
CP1 Lighter Cord	$9.50
DC1 DC Cord	$17.50
HM9 Speaker/Mic	$34.50
LC10 Leather Case	$34.95

IC-745
List Price $999
Compact General-Coverage
Full-Feature HF Transceiver
Call For Special Low Price!

IC-25A/H 2 mtrs
IC-45A 40 cm
Limited Quantity
Special Price Reduction
Call For Special Prices!

IC-290H 2 mtrs
IC-490A 70 cm
All-Mode Transceiver
Call For Special Price

IC-02AT
New 2m HT
Call For Special Price!

IC-120 1200 MHz Receiver
List $499 Call For Price

R71 Receiver
Call For Special Price

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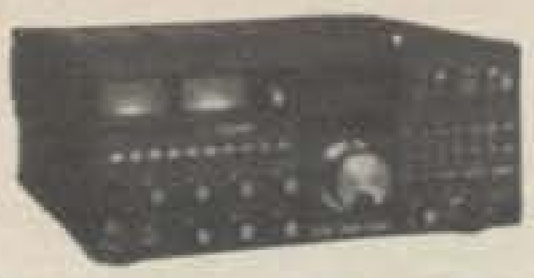
CIRCLE 28 ON READER SERVICE CARD

YAESU SPECIALS



FT980 CAT SYSTEM

AC Power Supply, Full Break-in CW, SSB/AM/FM/FSK, RF Speech Processor

List Price $1659

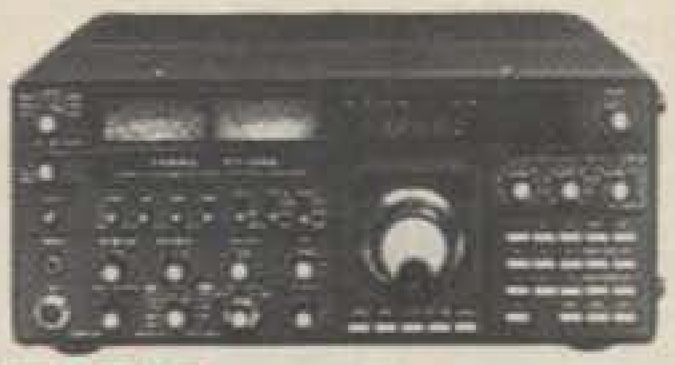
CALL FOR SPECIAL PRICE

FT757GX

with General Coverage RCVR includes CW keyer, AM/FM, CW filter

List Price $829

CALL FOR SPECIAL PRICE



FT-ONE

With Four Free Filters

List Price $3074

Limited Quantity For

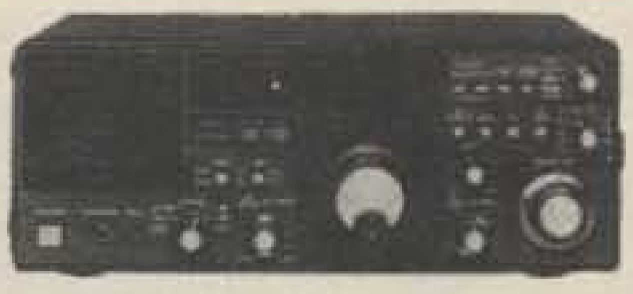
$1995.00 SAVE $1079

FT726R

(Optional modules for 6m, 430, 440 MHz) Great for Satellite Work

List $899.00

CALL FOR SPECIAL PRICE



FRG-7700 Receiver

List Price $499

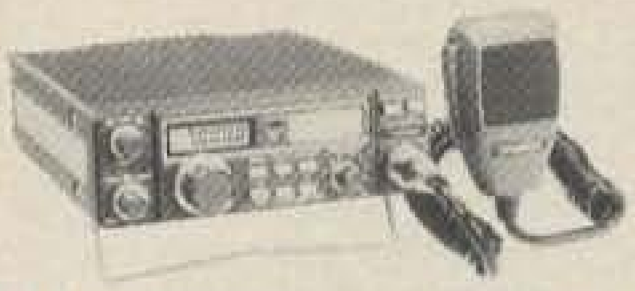
CALL FOR SPECIAL PRICE

FT-77

Perfect Mobile Rig

List $599

CALL FOR SPECIAL PRICE



FT-230R 2mtr FM........List $359
FT-730R 440 MHz FM....List $399

- 10 Memories
- Two VFO's
- LCD Readout
- 25W Out
- Memory of Up/Down Scan

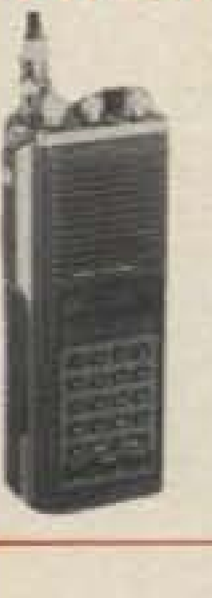
Call today for Special Discount Price & Save $$

VHF/UHF Multimode Portables

FT-690R 50MHz.......List $379
FT-290R 144MHz......List $399
FT-790R 430MHz......List $399

Call today for Special Discount Price & Save $$

FT208R 2m HT
FT708R 70cm HT



FT208R List $319
FT708R List $319

CALL FOR SPECIAL PRICES

Accessories Available:

LCC-8 Leather Case	$35
YM24A Spkr/Mic	$39
FNB-2 Nicad	$29
NC-8 Base Chgr	$99

FT203R

New 2 mtr HT w/VOX
Special Promo
w/Free VH-2
Headset
$239 Value

$219.00 SAVE $20.00

TEN-TEC SALE!

CORSAIR List $1169
Deluxe AC Supply List $199
Both Items—Yours for $1169!

TEN-TEC
New 2M HT
Full Featured!
List $319
Sale $279.95!

4229 2KW Tuner Kit $189.95!

AZDEN PCS 4000

CALL FOR SPECIAL PRICE

CP-1 COMPUTER PATCH
List $239.95 SALE $189.95!

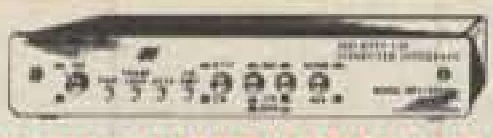
CP1-20	$219	CP1-64	$219
MP-20	$119	MP-64	$119
VIC-20 MBAText	$79	C-64 MBAText	$79

All AEA Keyers, Antennas & Accessories In Stock!

KANTRONICS

The Interface Reg. $169.95 Sale $129.95
The Interface II Reg. $269.95 Sale $239.95

Apple Amtor Soft/Hamtext	$139	VIC-20 Hamsoft	49
Vic-20 Amtor Soft	89	Hamtext VIC-20	99
Model 64 Amtor Soft	89	Hamtext Model-64	99
Apple Hamsoft	29	Atari Hamsoft	49
		TRS-80C Hamsoft	59



MFJ 1224 COMPUTER INTERFACE $89.95

202B Noise Bridge	$59.95
250 2KW Oil Load	$35.95
422 Keyer/Paddle	$89.95
901 300W Tuner	$59.95
941C 300 W Tuner	$89.95
989 Deluxe 2KW	$299.95

MIRAGE AMPLIFIER SALE!

B1016
$249

Model	Band	Pre-amp	Input	Output	DC Pwr	Sale Price
A1015	6M	Yes	10W	150W	20A	$249
B23	2M	No	2W	30W	5A	$ 79
B215	2M	Yes	2W	150W	22A	$259
B108	2M	Yes	10W	80W	10A	$159
B1016	2M	Yes	10W	160W	20A	$249
B3016	2M	Yes	30W	160W	17A	$199
C22	220	No	2W	20W	5A	$ 79
C106	220	Yes	10W	60W	10A	$179
C1012	220	Yes	10W	120W	20A	$259
D24	440	No	2W	40W	8A	$179
D1010N	440	No	10W	100W	20A	$289

RC-1 Remote Control for Mirage Amplifiers	$24
MP-1 and MP-2 Peak-Reading Wattmeter	$99

SANTEC

NEW ST142μP 2M HT

$289

SANTEC Accessories

SM3 Speaker Mic	$34.95
ST-LC Leather Case	$34.95
ST-500 NiCad Battery	$29.95

KDK FM2033

List $339 Sale $299

TOKYO HY-POWER AMPLIFIERS

HL30V 2m Amp 2-30 FM	59.95
HL32V 2m all-mode Amp 2-30	75.00
HL82V 2m Amp & Preamp 10-80	139.95
HL160V 2m Amp & Preamp 2/10-160	288.95
HL20U 440-450 MHz Amp 2-20	98.95
HL90U 430-440 MHz Amp 10-90	319.00

TOKYO HY-POWER TUNERS

HC200 300-watt, Meter & Switch	86.95
HC2000 2000-watt, Meters & Switch	289.95

WELZ

TP5X Handheld Watt Meter	18.95
SP10X 1.8-150 MHz Watt Meter	32.95
SP250 1.6-60 MHz Watt Meter	65.00
SP600 1.6-500 MHz Watt Meter	139.95

HAL SALE!
NEW RTTY/CW COMPUTER INTERFACES

CRI-100 List $249 SALE $229.95!
CRI-200 List $299 SALE $269.95!

CWR6850 RTTY/CW TERMINAL

List $999 SALE $749.95!

Other HAL Products On Sale

CWR6700	$439.95	DS3100ASR	$1699.95
CWR6750	$629.95	MPT3100	$2199.95
CT2100/KB2100	$749.95	RS2100	$289.95
CT2200/KB2100	$949.95	ST5000	$219.95
DSK3100	$1049.95	ST6000	$649.95
ARQ1000	$649.95	KG-12	$169.95

ASTRON POWER SUPPLIES

Heavy Duty · High Quality · Rugged · Reliable

- Input Voltage: 105–125 VAC Output 13.8 VDC ± .05V
- Fully Electronically Regulated—5mV Maximum Ripple
- Current Limiting & Crowbar Protection Circuits
- M-Series With Meter—A-Series Without Meter

Model	Cont. Amps	ICS Amps	Price
RS4A	3	4	$ 39
RS7A	5	7	49
RS12A	9	12	69
RS20A	16	20	89
RS20M	16	20	109
RS35A	25	35	135
RS35M	25	35	149
RS50A	37	50	199
RS50M	37	50	229

MODEL RS-50A

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CIRCLE 68 ON READER SERVICE CARD

ANTENNA/TOWER SALE!

hy-gain

CRANKUP SALE!

All Models Shipped Factory Direct—Freight Paid*!

Check these features:

- All steel construction
- Hot dip galvanized after fabrication
- Complete with base and rotor plate
- Totally self-supporting—no guys needed

Model	Height	Load	Sale Price
HG37SS	37 ft.	9 sq. ft.,	$ 719
HG52SS	52 ft.	9 sq. ft.,	$1049
HG54HD	54 ft.	16 sq. ft.,	$1629
HG70HD	70 ft.	16 sq. ft.,	$2599

Masts—Thrust Bearings—Other Accessories Available—Call! Prices Shown Are Your Total Delivered Price In Continental U.S.A.!

ROHN

Self Supporting Towers On SALE!

FREIGHT PREPAID

- All Steel Construction—Rugged
- Galvanized Finish—Long Life
- Totally Free Standing—No Guy Wires
- America's Best Tower Buy—Compare Save $
- Complete With Base and Rotor Plate
- In Stock Now—Fast Delivery

Model	Height	Ant. Load*	Weight	Delivered Price*
HBX40	40 ft	10 sq ft	164	$319
HBX48	48 ft	10 sq ft	303	$399
HBX56	56 ft	10 sq ft	385	$489
HDBX40	40 ft	18 sq ft	281	$379
HDBX48	48 ft	18 sq ft	363	$469

*Your Total Delivered Price Anywhere in Continental 48 States. Antenna Load Based on 70 MPH Wind.

Tri-Ex®

These rugged crankup towers now available from Texas Towers! All models available On Sale for tremendous savings to you!

To save on freight costs, all towers are shipped directly from the Tri-Ex factory to you!

Check these features:

- **All steel construction**
- **Hot dip galvanized after fabrication**
- **Complete with base and rotor plate**
- **Totally self-supporting—no guys needed**

Model	Height Up	Down	Wind Load	List	Sale
W36	36.0 ft	20.5 ft	9.0 sq ft	$694	$579
WT51	51.0 ft	20.5 ft	9.0 sq ft	$1154	$999
LM354	54.0 ft	21.0 ft	16 sq ft	$2010	$1599
LM470D (Motorized)	70.0 ft	22.0 ft	16 sq ft	$4195	$2999
DX86 (Motorized)	86.0 ft	23.0 ft	25 sq ft	$7200	Call

BUTTERNUT ELECTRONICS CO.

- Designed to operate on all Amateur Bands at "FULL" Legal Power Input.
- Automatic Band Switching (80/10 meters).
- Automatic Band Switching (160/10 meters) with optional model TBR-160 HD.
- IN STOCK for IMMEDIATE DELIVERY & LOOK at very SPECIAL PRICES . . .
- New Model HF6V $129.00
- New Model TBR-160HD (High Power 160 meter Base Resonator) $49.00.

Model RMK-11 (roof mount kit with multiband radial kit $39.00.

Model STR-2 (Stub Tuned Radial Kit) $29.00.

Delivery Anywhere In The Continental USA At No Additional Cost. (Free Shipping On Butternut Accessories Also When Purchased With Antenna.)

RG-213U

$.29/ft $279/1000 ft
Up to 600 ft via UPS

- RG-213/U—95% Bare Copper Shield
- Mil-Spec Non-contaminating Jacket for longer life than RG8 cables.
- Our RG-213/U uses virgin materials.
- Guaranteed Highest Quality!

RG-8X

$.19/ft $179/1000 ft

- RG8X—95% Bare Copper Shield
- Non-contaminating Vinyl Jacket
- Low Loss Foam Dielectric

Coaxial Cable Loss Characteristics (DB/100 ft)

Cable Type	Imped.	10MHz	30MHz	150MHz	450MHz
RG-213/U	50	.6	.9	2.3	5.2
RG8X	52	.8	1.2	3.5	6.8
RG-58/U	52	1.4	1.9	6.0	12.5
½" Alum	50	.3	.5	1.2	2.2
½" Heliax	50	.2	.4	.9	1.6
⅞" Heliax	50	.1	.2	.5	.9

HARDLINE/HELIAX™

Lowest Loss for VHF/UHF!

½" Alum. w/poly Jacket	$.79/ft
½" LDF4-50 Andrew Heliax ™	$1.69/ft
⅞" LDF5-50 Andrew Heliax ™	$3.99/ft

select connectors below.

HARDLINE & HELIAX ™ CONNECTORS

Cable Type	UHF FML	UHF MALE	N FML	N MALE
½" Alum	$19	$19	$19	$25
½" Heliax ™	$22	$22	$22	$22
⅞" Heliax ™	$49	$49	$49	$49

AMPHENOL CONNECTORS

Silver PL259	$1.25	UG23D N Female	$2.95
UG21B N Male	$2.95		

ANTENNA WIRE & ACCESSORIES

14 Ga. Stranded Copperweld	$.10/ft
450 Ohm H.D. Line	$.16/ft
18 Ga. Copperweld ¼ mi	$30
H.D. End Insulators	$2/ea
Van Gorden 1:1 Balun	$11
Van Gorden Center Insulator	$6

HUSTLER

		6BTV 80-10 mtr Vert.	$129
4BTV 40-10 mtr Vert	$89	5BTV 80-10 mtr Vert.	$109
G6-144B 2-mtr Base	$89	G7-144 2-mtr Base	$119

Mobile Resonators	10m	15m	20m	40m	75m
400W Standard	$12	$12	$15	$18	$22
2KW Super	$18	$20	$22	$26	$36

Bumper Mounts - Springs - Folding Masts in Stock!

CUSHCRAFT

MULTI-BAND HF ANTENNAS

A3 3-el Tribander	$219	A4 4-el Tribander	$289
R3 20/15/10mtr Vert	$279	A743/A744 40mtr Kit	$75

HF MONO-BAND ANTENNAS

10-3CD	$ 95	10-4CD	$109
15-3CD	$119	15-4CD	$129
20-3CD	$199	20-4CD	$279
40-2CD	$289	D40	$149

VHF/UHF BEAMS

A50-5	$ 79	617B	$199
214B	$ 79	3219	$ 95
220B	$ 95	424B	$ 79

OSCAR/TWIST ANTENNAS

A144-10T	$ 52	A144-20T	$ 75
A147-20T	$ 63	416TB	$ 59
A14TMB	$ 29	PS4	$ 69

VHF/UHF FM ANTENNAS

A147-4	$ 29	A147-11	$ 49
214FB	$ 79	228FB	$219
A449-6	$ 29	ARX2B	$ 39

HY-GAIN

Discoverer 2-el 40-mtr Beam	**$319**
Discoverer 3-el Conversion Kit	**$199**
Explorer-14	$309
QK710 30/40 mtr. Add-On-Kit	$79
V2S 2-mtr Base Vertical	$49
TH5MK2S Broad Band 5-el Triband Beam	$389
TH7DXS 7-el Triband Beam	$439
TH3JRS 3-el Triband Beam	$189
TH2MK3S 2-el Triband Beam	$179
205BAS 5-el 20-mtr Beam	$349
155BAS 5-el 15-mtr Beam	$199
105BAS 5-el 10-mtr Beam	$129
204BAS 4-el 20-mtr Beam	$259
64BS 4-el 6-mtr Beam	$69
66BS 6-el 6-mtr Beam	$135
18HTS 80-10 mtr Hy-Tower Vertical	$439
LC-160 160-mtr Coil Kit for 18HTS	$45
214BS 14-el 2-mtr Beam	$49
2BDQ 80/40 mtr Trap Dipole	$69
5BDQ 80-10 mtr Trap Dipole	$129
BN86 80-10 mtr KW Balun W/Coax Seal	$22

MOSLEY

Pro37 7-el Triband Beam	$469
CL-33 e-el Triband Beam	$279
TA-33 3-el Triband Beam	$249
TA-33JR 3-el Triband Beam	$189
TA40KR 40 mtr Kit for TA33	$119

MINI-PRODUCTS HQ-1

LIST $182.50 SALE $159

- Wing Span - 11 ft
- Wind Area - 1.5 sq ft
- Boom - 54 in. long
- 1200W P.E.P. Input

ALPHA DELTA COMMUNICATIONS

Transi-Trap ™ Surge Protectors—In Stock Now!

Model LT 200W UHF Type	$19
Model HT 2KW UHF Type	$29
Model LT/N 200W N Type	$39
Model HT/N 2KW N Type	$44
Model R-T 200W Deluxe	$29
Model HV 2KW Deluxe	$32

KLM

KT34A 4-el Broad Band Triband Beam	$339
KT34XA 6-el Broad Band Triband Beam	$489
80m-1 80-mtr Rotatable Dipole	$469
40m-1 40-mtr Rotatable Dipole	$179
40m-2 2-el 40-mtr Beam	$309
40m-3 3-el 40-mtr Beam	$439
40m-4 4-el 40-mtr Beam	$649
20m-6 6-el 20-mtr Beam	$689
15m-6 6-el 15-mtr Beam	$439
10m-6 6-el 10-mtr Beam	$259
10-30-7LPA Log Periodic Beam	$639
2m-13LBA 13-el 2-mtr Beam	$79
2m-14C 14-el 2-mtr Satellite Antenna	$89
435-18C 435 MHz Satellite Antenna	$65
432-16LB 16-el 432 MHz Beam	$69

ROTORS & CABLES

Alliance HD73 (10.7 sq ft rating)	$109
Alliance U110 (3 sq ft rating)	$49
Telex HAM 4 (15 sq ft rating)	$219
Telex Tailtwister (20 sq ft rating)	$269
Telex HDR300 Heavy Duty (25 sq ft rating)	$519
Kenpro KR-500 Heavy duty elevation rotor	$189.00

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FK4554	54 ft	29.1 sq ft	$1259
FK4564	64 ft	28.4 sq ft	$1359
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45G Foldover Double Guy Kit			$229

*Above antenna loads for 70 MPH winds and Guys at Hinge & Apex.

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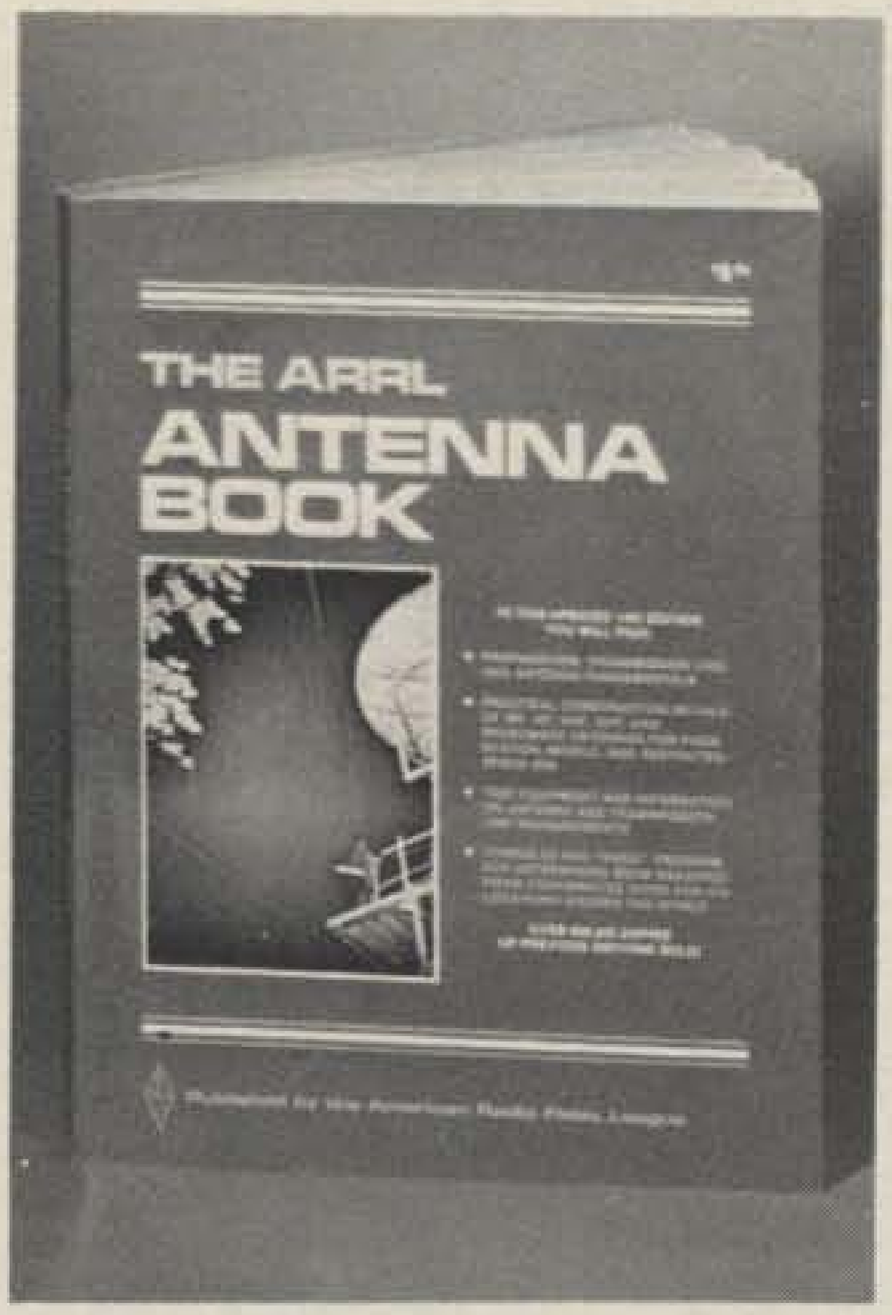

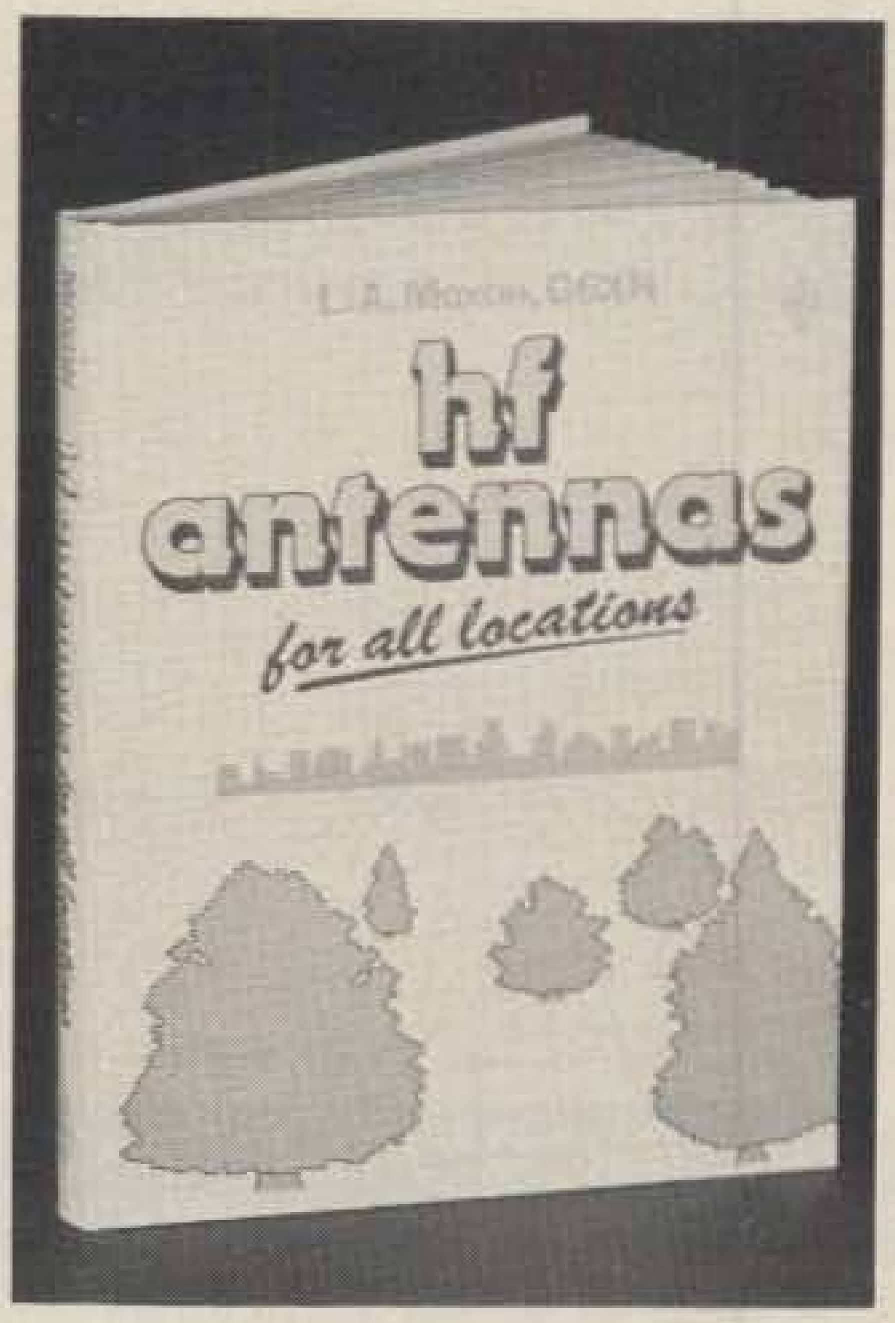

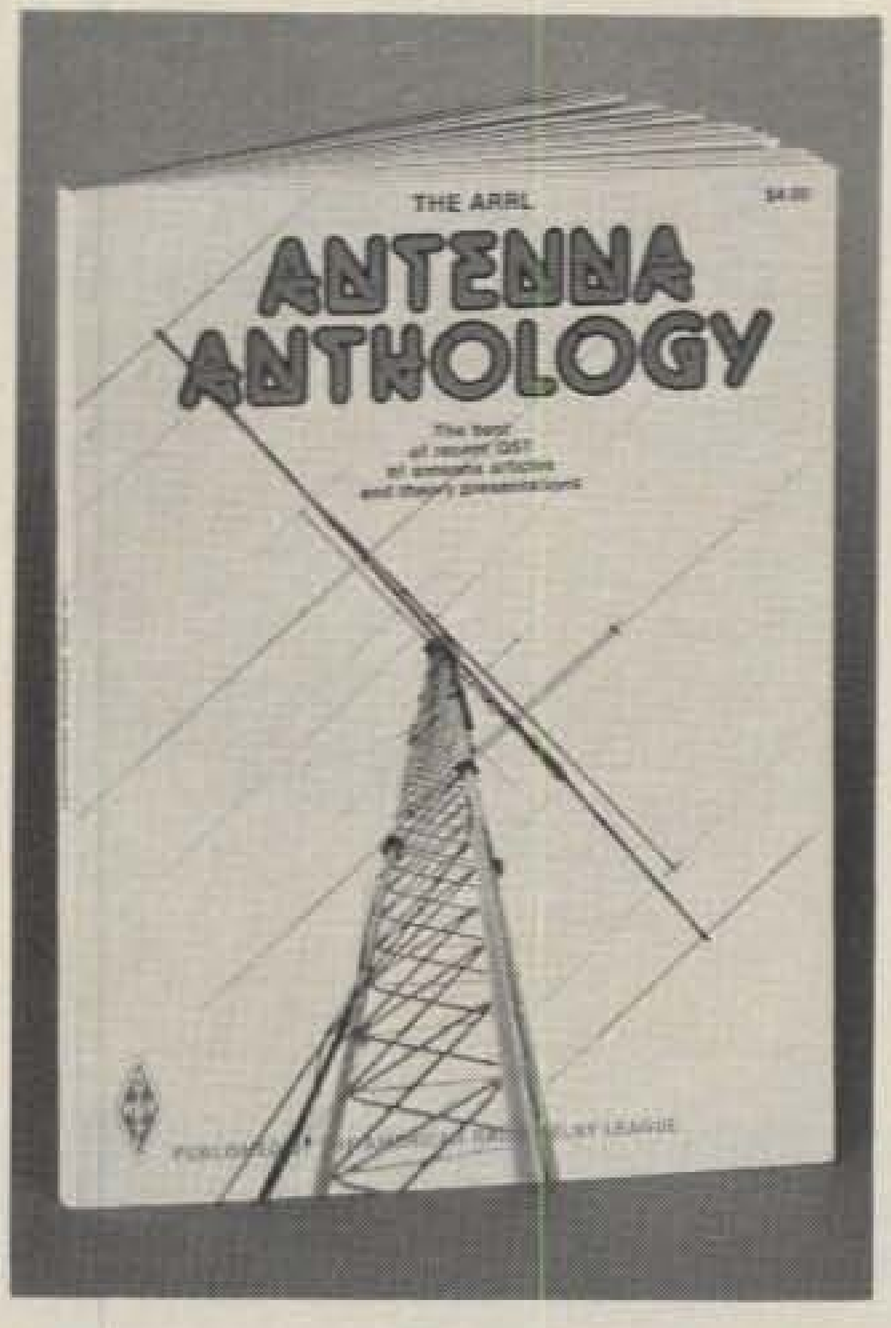

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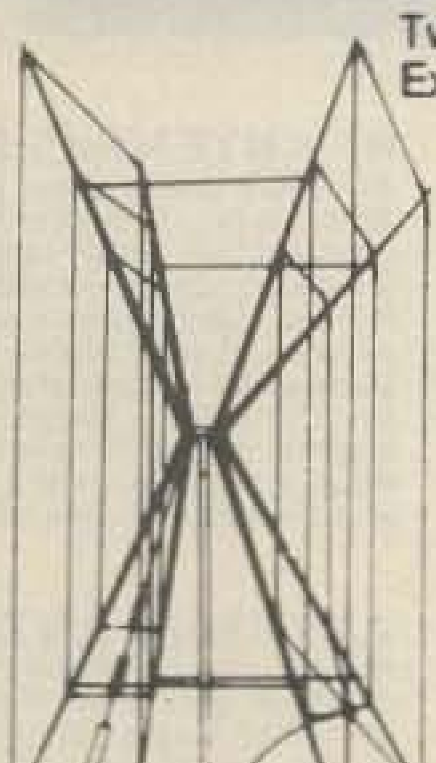

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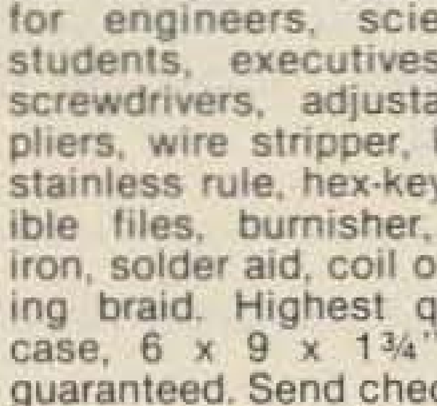

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●**Elmer-of-the-Year Nominations Called For** - Nominations from and for licensed amateur radio operators who reside in northern New Jersey are now being accepted for the Elmer-of-the-Year Award sponsored by the Northern New Jersey Chapter of the QCWA. The award is given to the amateur in northern New Jersey who has done the most to pass on the knowledge he or she has gained over the years to the next generation of amateurs. Presentation of the award will be on October 26. Each nomination must be accompanied by a statement (500 words or less) detailing the reasons why the nominee is deemed worthy of the award. All nominations must be received on or before September 15 by the chairman of the chapter's Elmer Award Committee. Direct all communications to John J. Brischler, W2SGI, 34 Franklin St., Little Ferry, NJ 07643 (telephone 201-641-4251).

●**First Australian Amateur Radio Convention** - An Australian Amateur Radio Convention is being planned for early in 1985 as a primer for an annual event to be held in Sydney. The convention will include the presentation of papers, technical tours, exhibits, awards, and more. Those clubs and individuals interested in attending or taking part in the convention are asked to contact Rob McKibbin, VK5ARO, Australian Amateur Radio Convention, P.O. Box 32, Modbury North 5092, South Australia. (A specific date for the convention had not yet been chosen as of the writing.)

●**KF2T From Oyster Creek, NJ** - The Jersey Shore ARS will operate KF2T from the Oyster Creek, NJ, Nuclear Generating Station betwen 1400Z August 4 and 1800Z August 5. Phone operations will be near 3930, 7270, 14270, 21270, and 28570 kHz; c.w./Novice-Tech 30 kHz from lower band edges; v.h.f. on 146.48; RTTY on 3640, 7080, and 14080. A special QSL will be available for s.a.s.e. to JSARS, 619 17th Ave., South Belmar, NJ 07719.

●**Scotch Plains, NJ, Special Event** - The Tri-County Radio Assoc. will sponsor W2LI on August 11 starting at 1300Z. Phone operation is planned for the lower 25 kHz of the General portion of 40 meters, plus other bands as conditions permit. A commemorative QSL will be available for #10 s.a.s.e. to Tri-County Radio Assoc., Box 412, Scotch Plains, NJ 07076.

●**KA9NGH/4 From Pigeon Key, FL** - In conjunction with the Urbana (IL) High School, KA9NGH/4 will operate from Pigeon Key, FL, the University of Miami Marine Science Institute. Operation will be on August 11–12 from 1600–0600 GMT in the Novice band around 7.125 and 3.725 c.w., with 15 meter operation also possible. For special QSL send s.a.s.e. to KA9NGH, Sean Kutzko, 902 E. Washington St., Urbana, IL 61801.

●**Bemidji ARC's Special Event** - The Bemidji ARC will operate KC0MJ on August 11–12 from 1400–2200Z 10 kHz up from the lower edge of the General class phone bands on 20, 40, and 80 meters. To receive a certificate send 9 × 12 s.a.s.e. to Bemidji ARC, P.O. Box 524, Bemidji, MN 56601.

●**Space Day 84** - The Cascades ARS in conjunction with the Michigan Space Center is offering a certificate to stations who work WB8CSQ during Space Day activities starting at 0000 GMT August 18 through 1700 GMT August 19. Frequencies: 3.900, 7.235, 14.285, 21.360, and 28.510. Mail log information and $1.00 to CARS, Space Day 84, P.O. Box 512, Jackson, MI 49204.

●**Bergen ARA To Operate K2TM** - The Bergen (NJ) ARA will operate K2TM from 1500–2400Z August 18–19 to celebrate the club's 21st anniversary. Frequencies: 7.235, 14.275, 21.375, 28.675, 146.520; Novice 7.125. Certificate for large s.a.s.e. and QSL to K2UFM, 31 Forest Drive, Hillsdale, NJ 07642.

●**ABC Radio Club's KA9KOL** - The Amateurs for Better Communications Radio Club of northern Illinois will operate KA9KOL on August 18–19 from 1700–2300Z from Lindenhurst, IL, on 7.240–7.245 and/or 14.280–14.285. QSL s.a.s.e. to KA9KOL, Terry Drews, 37326 N. Fairview W Ln., Lake Villa, IL 60046.

●**FRRL's Special Event Station** - The Fox River Radio League will operate W9CEQ from St. Charles, IL, on August 26 from 8 a.m. to 4 p.m. CDT up 10 kHz from the lower portions of the General class phone bands on 40, 20, and 15 meters. For a certificate or QSL send your QSL and s.a.s.e. to Fox River Radio League, P.O. Box 443, Aurora, IL 60507.

Aug. 4, **Beaver Valley ARC Swapfest,** Cominco Arena, Trail, B.C., Canada. Contact BVARC, c/o 3798 Woodland Dr., Trail, B.C. Canada V1R 2V7.

Aug. 4–5, **Greater Jacksonville Hamfest,** Orange Park Kennel Club, Jacksonville, FL. Contact Mike Parnin, N4EPD, 6716 Diane Rd., Jacksonville, FL 32211.

Aug. 5, **Shennandoah Valley ARC Hamfest,** Berryville, VA. Contact W4OHM.

Aug. 5, **South Hills Brasspounders and Modulators Hamfest,** Pittsburgh, PA. Contact Jack B. Wood, W3IQD, 448 Jenne Dr., Pittsburgh, PA 15236.

Aug. 10–12, **Austin Summerfest '84,** Austin, TX. Contact Austin Summerfest '84, P.O. Box 13473, Austin, TX 78711.

Aug. 11–12, **Panhandle ARC Hamfest,** Canyon, TX. Contact PARC, P.O. Box 10221, Amarillo, TX 79116, or call WB5UDX at 806-359-1022.

Aug. 11–12, **BARC International Hamfest,** Charlotte, VT. Contact WA1OZE, Burlington ARC, P.O. Box 312, Burlington, VT 05402.

Aug. 11–12, **Hamfair '84,** Tacoma, WA. Contact Grace Teitzel, AD7S, 701 South 120th, Tacoma, WA 98444.

Aug. 12, **Central Kentucky ARRL Hamfest,** Georgetown, KY. Contact Edward Bono, WA4ONE, 2077 Dogwood Dr., Lexington, KY 40504.

Aug. 12, **Hamfesters 50th Annual Hamfest,** Willow Springs, IL. Contact Hamfesters, P.O. Box 42792, Chicago, IL 60642.

Aug. 12, **St. Cloud ARC Hamfest,** Sauk Rapids, MN. Contact St. Cloud ARC, P.O. Box 141, St. Cloud, MN 56302.

Aug. 18–19, **Huntsville Hamfest,** Huntsville, AL. Contact Huntsville Hamfest, 2804 S. Memorial Parkway, Huntsville, AL 35801.

Aug. 19, **Ham & Computerfest '84,** Des Moines, IA. Contact Bob Tucker, KD0EO, P.O. Box 3711, Urbandale, IA 50322, or call 515-276-4415.

Aug. 19, **WARA Hamfest,** Warren, OH. Contact WARA, P.O. Box 809, Warren, OH 44485 (s.a.s.e.).

Aug. 19, **Lafayette Hamfest,** Lafayette, IN. Contact Tippecanoe ARA, 111 S. Seventh St., Lafayette, IN 47901.

Aug. 19, **Delmarva Hamfest,** Newark, DE. Contact the Amateur Radio Assoc. at the University of Delaware, 140 Evans Hall, University of Delaware, Newark, DE 19716 (s.a.s.e.).

Aug. 25, **Tioga County ARC Hamfest,** Blossburg, PA. Contact Carl E. Kimble, WB3EUE, P.O. Box 37, Cowanesque, PA 16918, or call 814-367-5345.

Aug. 25, **Finger Lakes Hamfest,** Trumansburg Fairgrounds, 12 miles NW of Ithaca, NY. Contact Wanda, KO2X, 443 Jerry Smith Rd., Lansing, NY 14882.

Aug. 26, **Great Salt Plains Hamfest,** Community Building, south side of Great Salt Plains Lake, north central Oklahoma. Contact Steven Walz, WA5UTO, Box 222, Cherokee, OK 73728, or call 405-596-3487.

Aug. 26, **Central Penn. Repeater Assoc. Hamfest/Computerfest,** Hershey, PA. Contact Timothy R. Fanus, WB3DNA, 6140 Chambers Hill Rd., Harrisburg, PA 17111, or call 717-564-0897 (12 noon to 8 p.m.).

Aug. 26, **GCARC Ham/Comp Fest,** Sewell, NJ. Contact Milt Goldman, K3WIL, 801 Crown Point Rd., Westville, NJ 08093, or call 609-456-0500.

Aug. 26, **Trunk 'n Trailer Bash,** Marshall, MI. Contact K8UCQ, 117 E. Michigan, Marshall, MI 49068 (s.a.s.e.).

Aug. 26, **Bluefield Hamfest, Computer & Satellite TV Fair,** Brushfork Armory-Civic Center, 1 mile north of Bluefield, WV. Contact Don Williams, WA4K, 412 Ridgeway Dr., Bluefield, VA 24605.

Aug. 26, **St. Charles ARC Hamfest,** St. Charles, MO. Contact Ron Ochu, KO0Z, 1914 N. 5th St., St. Charles, MO 63301.

Aug. 26, **Lebanon Hamfest,** Lebanon, TN. Contact Morris Duke, W4WXQ, 210 Disspayne Dr., Donelson, TN 37214.

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The W4TWW Coaxial Inverted "L" Antenna For 160 Meters

BY COLEMAN B. ROWLAND, W4TWW, AND JAMES E. MCQUEEN, JR.*, WB4LJP

I have been active on 160 meters since 1951, and I have tried many antennas for this band. Many of these antennas use some form of tuning network and cover only a portion of the band.

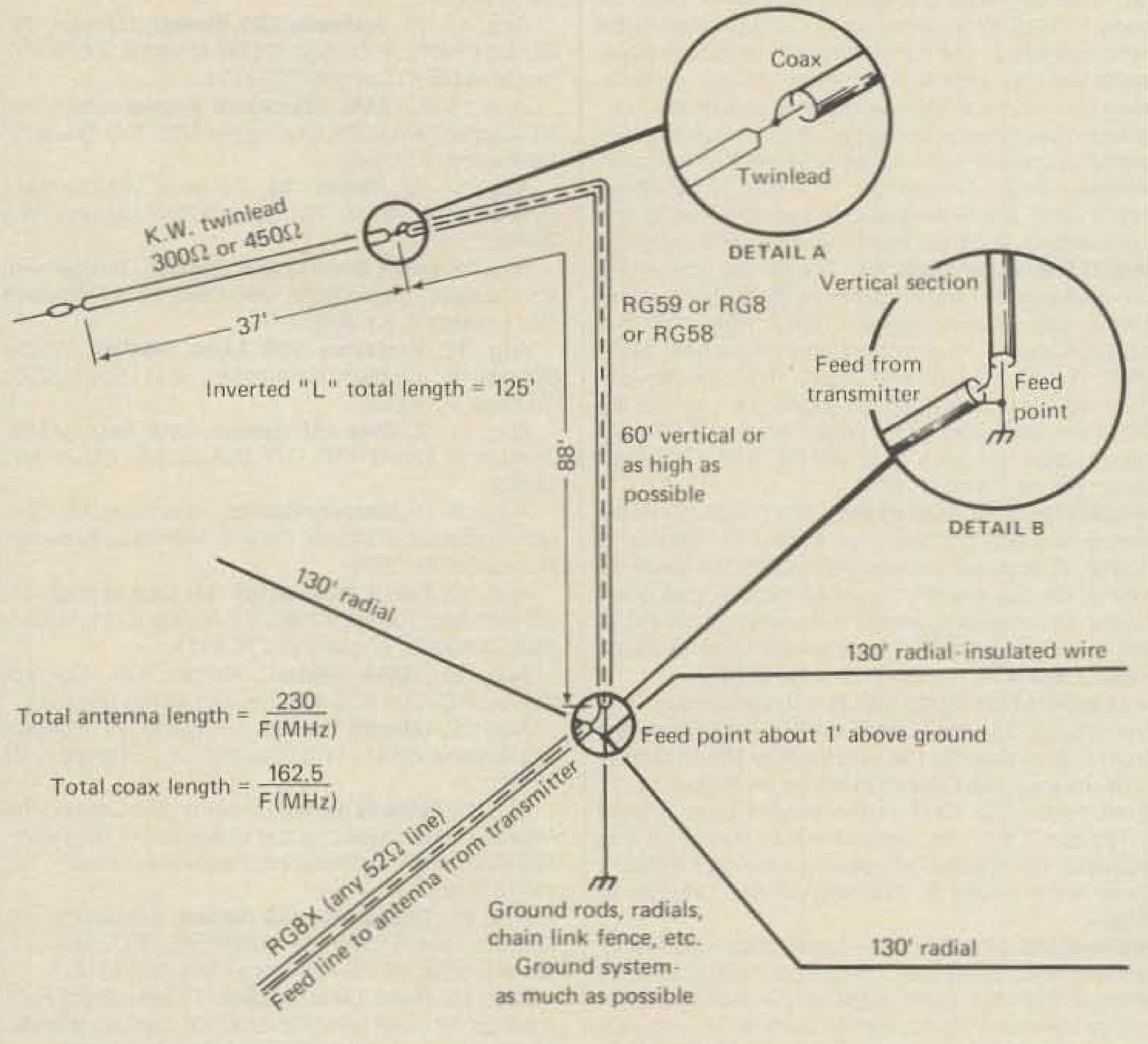
Several years ago when the restrictions began to be lifted on 160 meters, I started looking for a broad-band antenna that would cover the entire band. At one point in my research I remembered the double bazooka which I had used on 80 and 40 meters. I wondered if an adaptation of the bazooka might work as a ¼-wave vertical on 160 meters. As a result of my experimenting came the coaxial inverted "L" antenna, which provides vertical polarization and covers the entire band without tuning networks.

The antenna was developed from an article which appeared in the 1976 edition of *The Radio Amateur's Handbook*. The article described a broad-band dipole, or the double bazooka. The inverted "L" uses the same principle and techniques.†

Much has been written about the original antenna design in amateur radio publications. The concensus of opinion seems to be that it was not really as broad-banded as originally thought. Not being an antenna design engineer, I can only provide the following information gathered from my own experiences with this antenna.

The antenna provides complete coverage of the 160 meter band without any modification. At the design frequency of 1.840 MHz the s.w.r. is a perfect 1.1:1. At 1.8 MHz the s.w.r. is 1.3:1, and at 1.998 MHz the s.w.r. is only 1.5:1.

With all the discussion about s.w.r. I think it's necessary to make the following comment. My dummy load gives excellent s.w.r. at all frequencies, but it leaves much to be desired in radiation efficiency. The antenna not only exhibits good s.w.r., it also radiates an excellent signal.


Coax
Twinlead
DETAIL A
K.W. twinlead 300Ω or 450Ω
37'
Inverted "L" total length = 125'
RG59 or RG8 or RG58
60' vertical or as high as possible
88'
Vertical section
Feed from transmitter
Feed point
DETAIL B
130' radial
130' radial - insulated wire
Total antenna length = 230 / F(MHz)
Total coax length = 162.5 / F(MHz)
Feed point about 1' above ground
RG8X (any 52Ω line)
Feed line to antenna from transmitter
Ground rods, radials, chain link fence, etc. Ground system - as much as possible
130' radial

None of my radials is in a straight line. They follow the property line; any possible configuration is better than having none at all. None is buried.

Fig. 1– Details for constructing the coaxial inverted "L" antenna for 160 meters.

In my many contacts on 160 meters I am frequently asked to describe the type of antenna I am using. When I say I am using the coaxial inverted "L," I get requests for a description of the antenna and its construction.

I would like to clarify several areas in which questions frequently arise. First, the portion of the antenna which uses the twinlead does not have to use it. The entire antenna can be built from coax; however, as shown in Detail "A," the braid must be shorted to the center conductor at this point.

Another area concerns the number of ground radials that must be used to make

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**516 Holly Dr., Eufaula, AL 46027*

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†*Robert Myers, ed.*, The Radio Amateur's Handbook, *56th ed. (Newington, CT: The American Radio Relay League), pp. 599–600.*

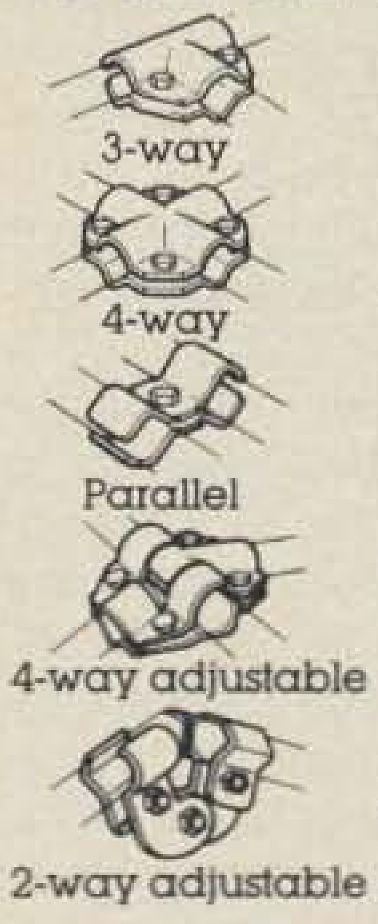
the antenna perform satisfactorily. I operate the antenna with several radials of different lengths to accommodate them on my property. None of the radials is buried, and not all of them are in a straight line. It is important to have a minimum of two or three radials exactly 130 feet long so the antenna will resonate correctly against the ground system, but you may add as many as you wish.

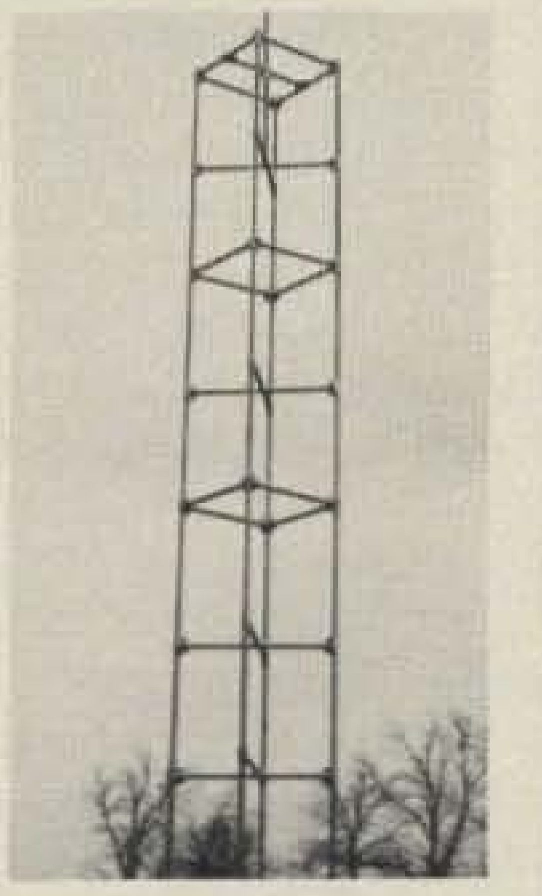
When you've finished tuning the antenna, an excellent way to determine if your ground system is up to par is to measure your s.w.r. and note it for future reference. The next time your location receives a good rain and the ground is wet, measure the s.w.r. again. If the s.w.r. remains the same, the ground system is sufficient; however, if the s.w.r. changes at this time, you need to add more ground radials. Once the s.w.r. does not change during periods of dry or wet weather, the ground system is sufficient for all practical purposes.

Many antennas of this type have been constructed in the last few years. Most have obtained excellent results. Here's hoping you enjoy this antenna as much as I have, and your results are as excellent as mine.

Special thanks to NV4I for helping to install my many antennas, to WB4LJP for the presentation of my material, and to the many amateurs who have helped in the refinement and testing of this antenna.

Build an Antenna Tower out of conduit





- Use ordinary, 3/4-inch electrical conduit, joined with durable FrameMaker™ clamps.
- Screwdriver, wrench and hacksaw are the only tools needed, and assembly is fast and easy.
- Can be made strong enough for permanent use, or less complex for temporary use (as in a field-day tower) depending on design.

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World of Ideas

a monthly feature by
DAVE INGRAM, K4TWJ

A LOOK AT THE WORLD AROUND US

Highlighting Our New OSCAR 10 Satellite

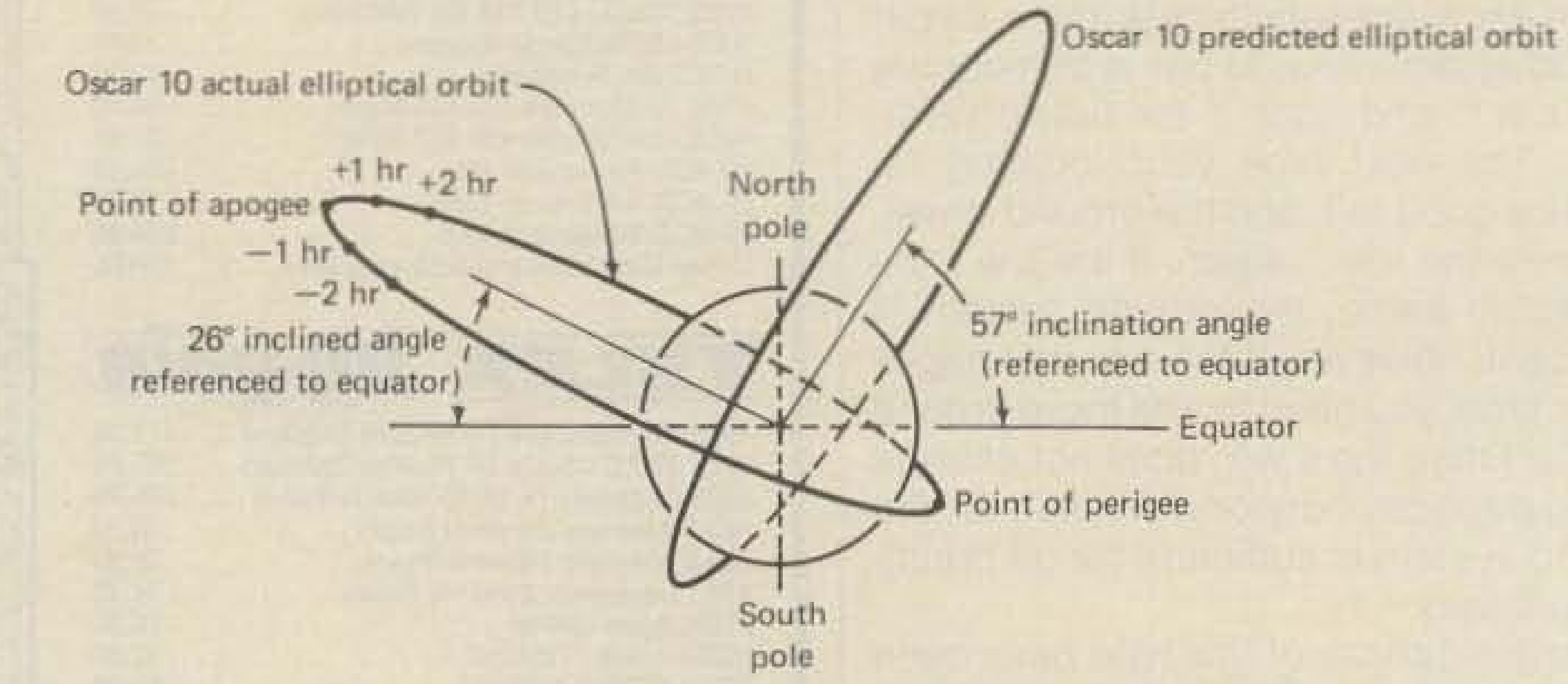
Oscar 10 predicted elliptical orbit
Oscar 10 actual elliptical orbit
+1 hr
+2 hr
Point of apogee
−1 hr
−2 hr
26° inclined angle (referenced to equator)
North pole
57° inclination angle (referenced to equator)
Equator
Point of perigee
South pole

Fig. 1– Comparison of predicted and actual elliptical orbits of OSCAR 10. Inclination angle is predicted to vary ± 26 degrees of the equator over a 2½ to 3 year period.

As you may have heard, our amateur satellite program has experienced several noteworthy developments during the last 12 months. As a result of those happenings, numerous amateurs worldwide are now enjoying what may easily be described as their most exciting operations to date. You can also join these fascinating activities, and a special knowledge of high-tech electronics or space communications isn't mandatory. What kind of activities are we describing? How about working Japan, Hong Kong, the Solomon Islands, Argentina, Qatar, or Jordan via 2 meters and 70 cm as starters? Giant antennas and super power stipulations? Not really. An r.f. output of 50 watts to a 10- or 16-element "twist" antenna plus a decent performance receiving preamp turns QSOs in fine style. The concept I'm describing is indeed real and operational at this very moment. It's the all-new era of our OSCAR 10 amateur satellite. Sound interesting? Read on!

Clearing the Air

A rather large number of amateurs have indicated confusion and/or misunderstanding of information regarding OSCAR 10, so let's begin this new frontier discussion with some straight-talk facts on the spacecraft and its use. Following a previous year's launch vehicle misfiring which sent our first Phase III satellite to the ocean's bottom, amateurs worldwide rallied to support AMSAT in producing a second, similar spacecraft. That bird, OSCAR 10, was launched on June 10, 1983. The satellite was space-ejected into a transfer orbit, from which its onboard kick motor was to shift it into a highly eliptical orbit inclined 57 degrees from the Equator. From that vantage point the satellite could provide almost full northern hemisphere communications up to 11 hours each day (see fig. 1). Conclusive information now reveals that the L6 launch vehicle "caught up" with OSCAR 10 some 55 seconds after separation, dealing it a hefty smack on the bottomside. The dazed satellite went spinning away, rescued only by the quick thinking of several very clever amateurs/controllers. The full effect of that mini-collision, however, wasn't realized until later.

OSCAR 10's kick motor was fired during July 1983—a one-shot maneuver which required that the highly corrosive fuel be used in its entirety. The resultant eliptical orbit was inclined only 26 degrees from the Equator. The satellite's long-distance communications capabilities were in no way lost, but they were noticeably altered. All previously prepared orbital calculation methods had to be significantly modified. Since the satellite now appears to rise in the sky closer to the Equator than to the North Pole, early 57-degree plotters thus are grossly inaccurate. Antenna-wise, northern hemisphere located amateurs using the satellite now point their beams in a more southerly (rather than northerly) direction. Additional details on those aspects later.

A Closer Look

Each group or phase of amateur satellites has exhibited significant advancement over its predecessors. Phase I satellites, for example, merely beeped ID's and measurements from space. Phase II satellites were low-orbiting and fast-moving 2 meter to 10 meter transponders which relayed communications between earth-based amateurs. Operating range was usually limited to 2000 or 3000 miles, and operating time was usually 18 or 25 minutes per pass. Old timers will surely recall fond memories of our now classic Phase I and Phase II satellites, OSCAR 1 and OSCAR 6, respectively.

OSCAR 10 is our first Phase III satellite. As such, it provides both "in country" and DX communications for many hours each day. It is interesting to note that signals from nearby amateurs or DX stations all return at nearly the same strength. Since the satellite appears almost stationary during an hour or two of operation, antenna trackings are miniscule (assuming, naturally, the station's antennas are initially pointed and "tweaked" in the proper direction). This "ionospheric alternative" (OSCAR 10) also features several measures intended to provide an overall satellite lifespan approaching 10 years.

OSCAR 10 is essentially a "morning bird" for U.S. amateurs, with best access times presently falling between 3 a.m. and 11 a.m. The satellite treks approximately 2.04 orbits within 24 hours—one within our (U.S.) range and the other on the earth's opposite side (orbit variations will be discussed later). As the satellite rapidly orbits its closest point to Earth (perigee) and begins trekking into space (toward apogee), DX signals begin to appear. As the satellite moves farther from Earth (and more lands gain line-of-sight access to the bird), activity begins to build. Intercontinental QSOs become optimum for a couple of hours plus/minus apogee, and then range slowly decreases. Satellite operations are not without consequence, however, as earth-based amateurs experience idiosyncracies resulting from the previously mentioned L6 launcher mishap—namely, weak-returned 2 meter signals at or near apogee due to a broken satellite antenna and spin modulation of signals when the satellite moves from apogee. These minor inconveniences can be sidestepped by use of high-gain low-noise (GaAsFET type) 2 meter preamps and various receiver AGC systems.

Joining the Action

Considering the various levels of approach and improvement with amateur satellite communications, this month's

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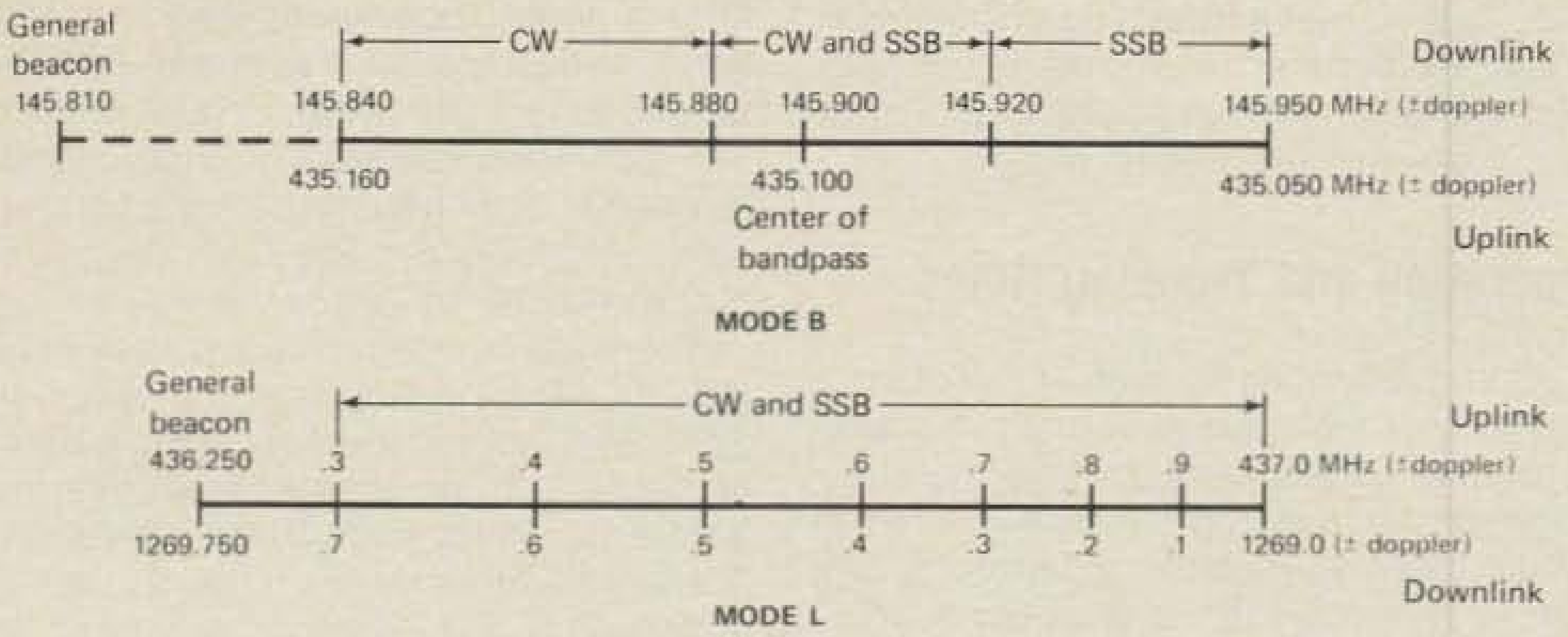
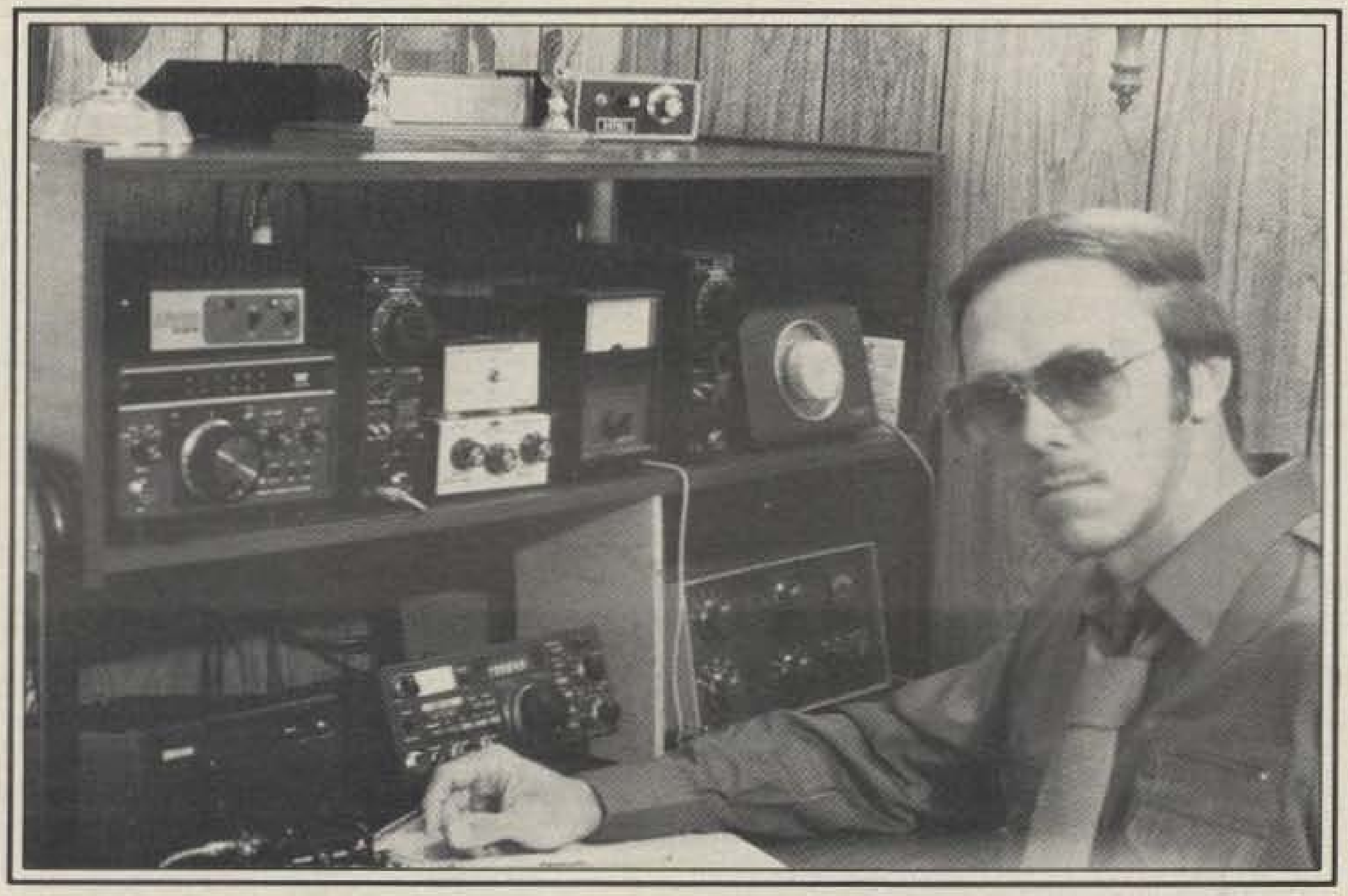


Fig. 2– Bandpass of transponders on OSCAR 10. Note inversions of frequencies between uplink and downlink.



OSCAR 10 gear at K4TWJ includes Ten-Tec's new 2510 operated with ICOM 730, and ICOM 202/402 s.s.b./c.w. transceivers (receiving preamp behind rigs). The Mirage D1010 amplifier is powered from the ICOM d.c. supply and can be used with either satellite rig/setup. ERP is continuously variable from 30 to 800 watts. H.f. setup with SSTV, RTTY, TS-930, KWM-1 and linear amplifier is on an adjacent desk.

column is presenting a general overview of ground station setups and tracking for OSCAR 10. If you're anxious to join the fun and/or have suitable gear at your disposal, you can become a satellite operator within the week. Next month's column will delve further into station gear selections/variations and setup, antenna notes and Effective Radiated Powers (ERP), operating techniques, etc.

OSCAR 10 is capable of two crossband-type operations: mode B, which uses 435.100 MHz (±60 kHz) uplink and 145.900 MHz (±60 kHz) downlink, and mode L, which uses 1269.050 to 1269.850 MHz uplink and 436.960 to 436.150 MHz downlink. The general reference beacon for mode B transmits continuously on 145.810 MHz, and the mode L beacon transmits on 436.250 MHz (see fig. 2). Due to the L6 separation mishap mentioned earlier, mode L utilized antennas and capabilities were severely crippled. OSCAR 10's prime activities thus center around mode B communications.

Amateur gear suitable for OSCAR 10 mode B operations include s.s.b./c.w. transceivers and/or transverters covering the previously outlined 70 cm and 2 meter frequencies (f.m. communications are strictly taboo via satellite). The ability to simultaneously transmit and receive on separate bands is especially important, as it lets you hear exactly when and how effectively your signals are "getting into the satellite." That full duplex operation is also necessary when "tweaking" antenna positions, zeroing other signals, operating during heavy spin modulation, etc. Some of the popular rigs being heard on the satellite include "twin" multi-mode ICOM units, Yaesu's new FT-726R full-duplex transceiver, and Ten-Tec's new 2510 satellite station. If your 2 meter receiver doesn't include a good GaAsFET-type preamp, you'll experience difficulties hearing the satellite when it's near DXciting apogee. "Outboard" preamps are manufactured by Lunar, Advanced Receiver Research, etc., and are available from dealers such as Henry Radio and Electronic Equipment Bank. Purchase according to lowest noise figure rather than highest gain.

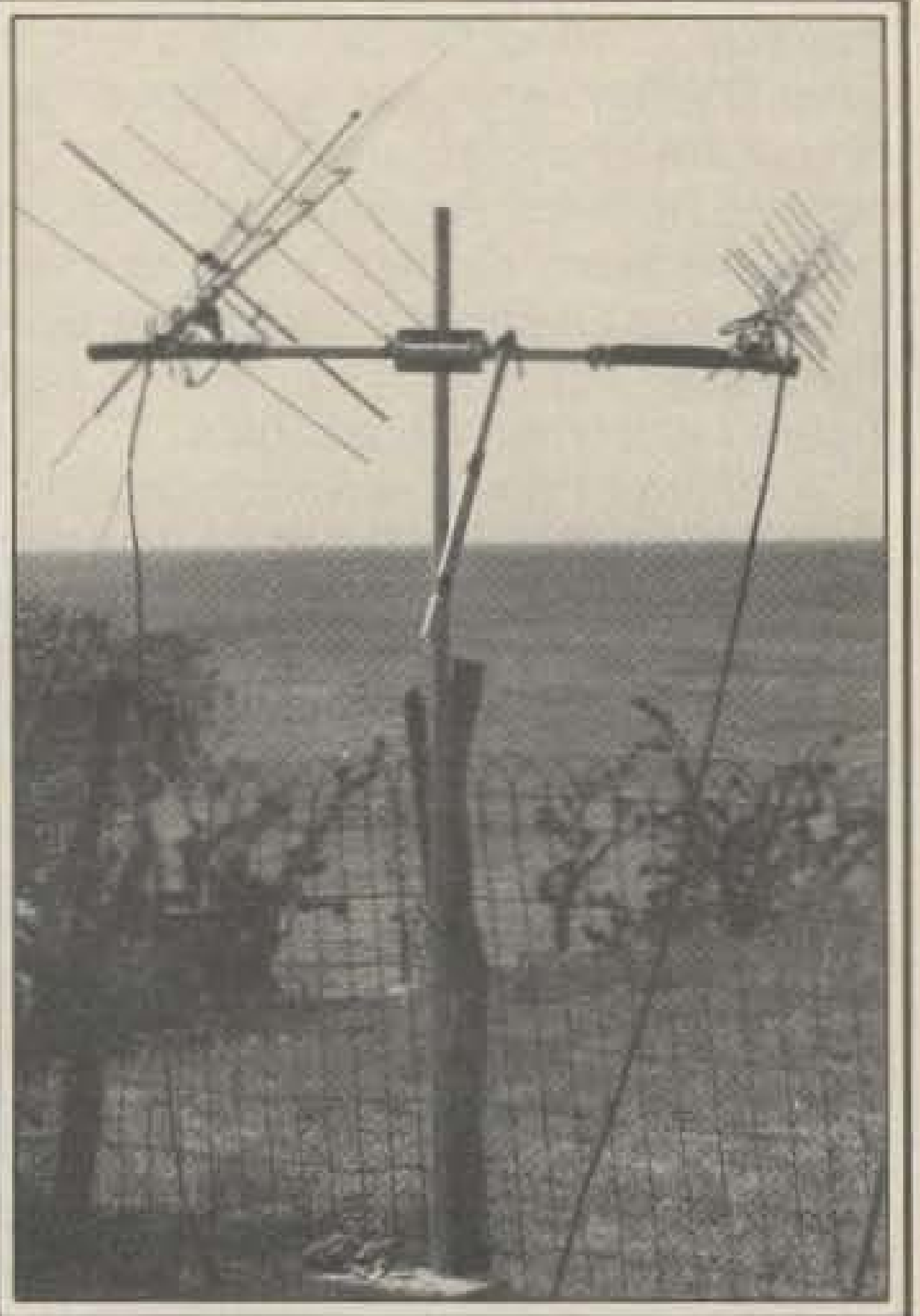
A 70 cm r.f. linear amplifier capable of producing between 20 and 80 watts output is particularly desirable for uplinking. However, that statement requires additional explanation. The typical mode B uplink power varies between 200 and 800 watts ERP—a measure which considers r.f. output, feedline loss, and antenna gain. Assuming you're directing 40 watts output to a 12 dB gain antenna, your ERP would be roughly 640 watts minus feedline and connector losses (each 3 dB doubles its previous power level). If you use 20 feet or less of top-grade RG-8 foam-filled coax without any breaks and with type-N connectors at each end, total loss shouldn't be over a dB. Approximately 500 watts ERP should prove quite sufficient for OSCAR 10 operations.

Satellite Antennas

The most popular antennas for satellite communications are crossed Yagis or twists for 70 cm and 2 meters. The antennas are usually mounted on a common crossboom and rotated in both azimuth (horizontal direction) and elevation (tilt above horizon). A nonmetallic crossboom is heartily suggested, as it doesn't distort radiation patterns or adversely affect s.w.r. Height above ground isn't a critical factor, provided the antennas clear nearby roofs and/or obstructions by at least one-half wavelength and enjoy a clear sky view in the satellite's general direction. Trees and foliage soak up r.f. energy like a sponge, thuse semi-blocking their particular directions/views.

Depending on your setup's r.f. output, the 70 cm twist antenna will probably consist of 16 to 20 elements (8 or 10 horizontal and 8 or 10 vertical). Don't go overboard in this ERP department, especially if your receiving setup isn't top notch or you have a noise-infested QTH (the alligator syndrome: all mouth and no ears). It's more respectful to be somewhat weak rather than abnormally strong on the satellite. Often compare your downlink signal with that of the 145.10 MHz beacon. Anyone stronger than that reference is frowned upon as an energy usurper. (The transponder's clamped AGC can "lock out" less powerful operators.) In-shack selectable right- or left-hand circular polarization is quite advisable. Although OSCAR 10 is set up for right-hand polarization, Faraday rotation of signals crossing the Earth's ionosphere occasionally shifts that parameter.

The 2 meter twist antenna should consist of at least 16 elements: 8 horizontal and 8 vertical. Polarization is right-hand circular and variations are not very com-



OSCAR 10 antennas at the tropical paradise of W1BIH/PJ2 in Curacao consist of Cushcraft 10-element "twist" for 2 meters and 16-element "twist" for 70 cm. Due to perfectly clear sky view, antennas need only be mounted 5 feet above ground and can be AZ/EL rotated by hand with rear counterweight. Note insulated pipe on crossboom. Most OSCAR 10 antennas look similar, except for this beautiful QTH's.

mon. Although satellite-relayed signals can be received with a multi-mode 2 meter rig connected to a simple 3-element beam, copy usually isn't adequate for reliable communications. Additionally, long boom and multi-element Yagis can be positioned to reduce interference from side or rear sources (such as power lines). Remember to weatherproof both connections and connectors. Moisture kills these high-frequency signals.

Operating and Tracking Notes

Communicating via OSCAR 10 bears a closer resemblance to actual h.f. operations than previous quick satellite chasings across evening skies. A couple of hours listening/monitoring before joining the action, however, is our best suggestion for initial satellite operating success. Bear in mind that the transponder has an inverting bandpass when zeroing signals on the satellite. A downlink signal received on 145.875 MHz, or 25 MHz below "center frequency" (145.900 MHz), thus will be zeroed using an uplink frequency near 435.125 MHz, or 25 kHz above "center frequency."

If your QTH is somewhat noise-laden, try using natural surroundings and phenomena to advantage. Antennas, for example, might be placed with their "back" toward power lines or with a building blocking direct interference. Corroded power-line clamps also become wonderfully quiet during rainy weather. Study, think, and improvise as required.

Many amateurs report best OSCAR 10 capabilities when the satellite appears in the skies west of their location. Satellite positions in eastern skies, however, usually require using a good antenna and preamp. Listen three hours on either side of published apogee times, remembering that relayed signals are stronger when the satellite is nearest earth (the transponder is switched off during true perigee, however, leaving only the 145.810 MHz beacon in operation). If spin modulation is excessive, stick with c.w. and use earphones for receiving. Finally, remember that Wednesdays are experimental days and not for general satellite communications. Mondays are QRP days. Use 100 watts ERP or less.

There are basically three ways of tracking OSCAR 10 orbits. The first and most attractive method involves using a home computer with suitable programming and data entered for your QTH. The AMSAT Software Exchange, P.O. Box 27, Washington, D.C. 20044, sells programs for Apple, Radio Shack, TI99, and IBM-PC computers. Send them an s.a.s.e. for details.

The next most attractive method involves using the new K2ZRO Satellipse printed plotter (analog unit similar to older OSCAR locators, but completely reworked for OSCAR 10). The plotter is supplied in "kit form"; you assemble and trace overlays according to your QTH. The ground track has to be redrawn every few months (but those tracks are difficult to find). The plotter must be referenced daily to either a Project OSCAR calendar (check with AMSAT or Henry Radio on availability of these items) or monthly apogee printouts must be obtained from the ARRL.

The third tracking method involves merely using monthly apogee/time printouts obtained from a friend or the ARRL (s.a.s.e.'s required). Using that information along with a world globe, position some object approximately 30,000 km scaled distance above the selected date's apogee longitude, and then "look from earth and/or satellite" to evaluate access and antenna positioning. U.S. stations "see" west longitude passes. Once you recognize OSCAR 10's 19–20 day orbital period, you're on track to becoming a true satellite operator.

Any discussion of OSCAR isn't complete without recognition of the organization which makes it all possible: AMSAT (P.O. Box 27, Washington, D.C. 20044). This group designs, constructs, and secures launches for amateur satellites. Once an orbiting bird is operational, it is then turned over to the ARRL for administration (and AMSAT proceeds with the next satellite). AMSAT and OSCARs are funded by amateur contributions and membership fees. It is only logical to join and support the group providing these "repeaters in the sky." AMSAT provides numerous satellite operating aids and promotions, plus their bimonthly magazine *ORBIT* is full of satellite information. If you operate OSCAR, we encourage your related support of the bird.

Next month we'll delve further into OSCAR 10, with equipment mini-reviews, station layout ideas, operating notes, etc. Watch for it! Meantime, we'll be listening for you on the bird!

73, Dave, K4TWJ

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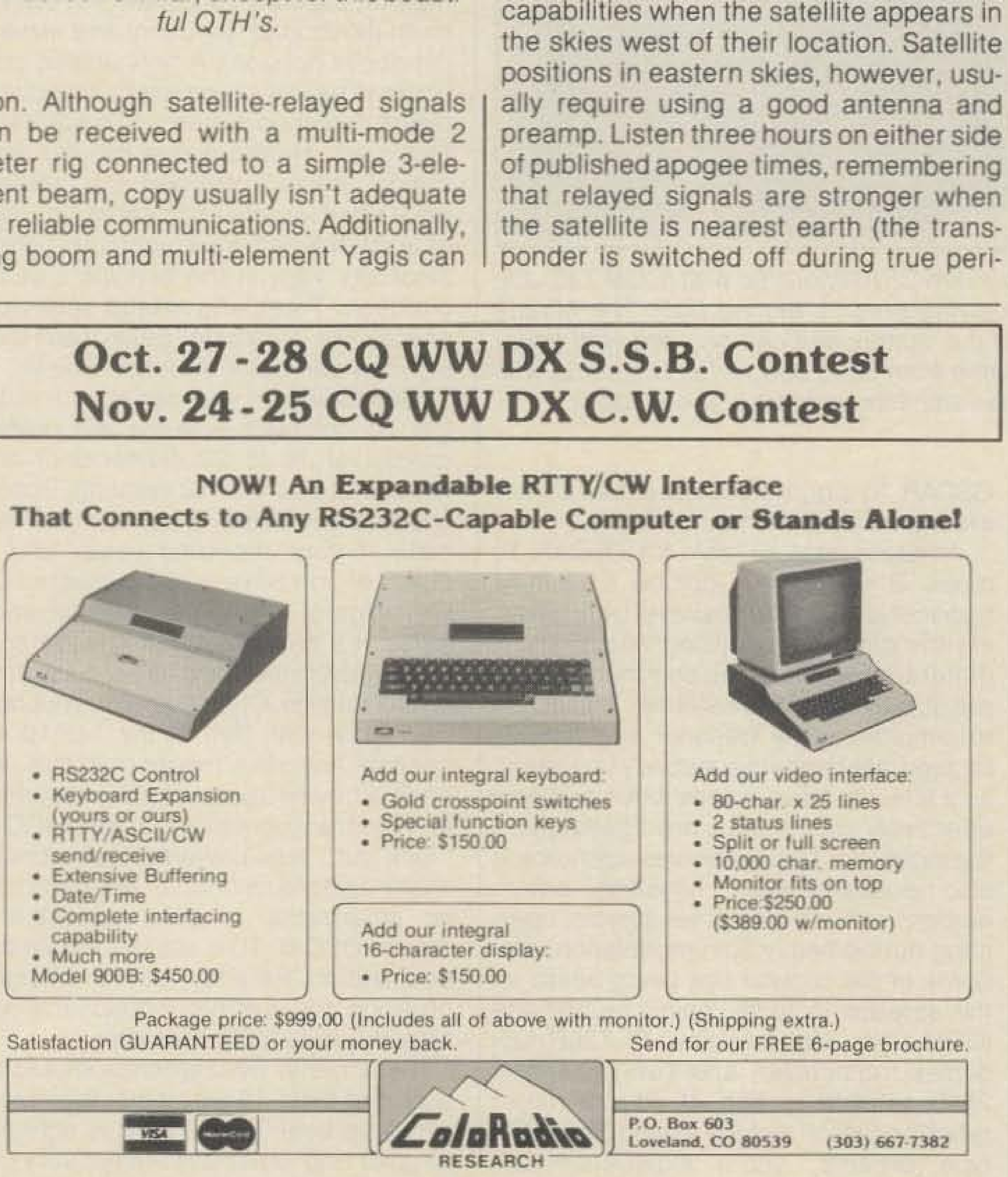
Nov. 24 - 25 CQ WW DX C.W. Contest



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Awards

a monthly feature by
DOROTHY H. JOHNSON, WB9RCY

NEWS OF CERTIFICATE AND AWARD COLLECTING

The story of the month as told by Ron is:

Ron Sundsboe, WA0MQM
All Counties #425, 6-2-83

"One of the people who helped me start in ham radio was the late Vic Clarence, W0GYM, USA-CA #6. In 1969 he encouraged me to take time out from DXing to work all counties. He even supplied me with the record books, etc.

"During all these years of county hunting, I have worked counties, given them out mobile, and been net control. But since I have muscular dystrophy, as time has gone by my mobile trips have become very limited, and I have cut down on being net control or assistant because of a speech problem associated with my physical problem.

"I was born 35 years ago on December 27th. At age 7 it was discovered that I had muscular dystrophy. I was about 12 years old before I started having any great physical difficulties. At age 14 I had to begin using a wheelchair full time, which created a dispute with the city school system concerning the 'disturbance' to the other students in the classroom by my wheelchair. By the time the dust cleared, I had dropped out of school, and during the next three years I spent my time reading and listening to music and commercial shortwave stations. By this time my father had retired, so we did extensive traveling throughout Canada, Mexico, and the United States.

"All through my life I have been exposed to ham radio. One of my best friends got his license when he was 12. At that time I had learned the code but did not go further. Several local friends and relatives were also hams.

"With the help and encouragement of Vic, W0GYM, and others, I finally got my General class ticket in 1965 when I was 17. I began county hunting in 1969 and received my USA-CA All Counties Award on June 2, 1983.

"I still live at home with my parents, who have been very patient and helpful during my many hours at the radio. My shack is in what would have been the third bedroom of our house.

Ron Sundsboe, WA0MQM, All Counties #425, in his shack.

QTH and antenna system of WA0MQM in Omaha, Nebraska.

"An interesting thing happened as I was about to work my very last county. The mobile thought that Carter, Montana was my last for the state, not realizing that the contact would finish the whole thing. He was quite surprised to find out later that he had given me the last one for USA-CA #425. I shall always remember the thrill of getting my last county, and with my #425 I am very honored to finally become a member of this special and elite group—73, Ron, WA0MQM."

Awards Issued

Father Terry Koch, K6HZI, took time from his mobile trips to complete his paperwork and was awarded USA-CA All Counties #471, 4-2-84, All 20 Meter Mobile, S.S.B.

Dean L. Molen, N7CYQ, completed them all before sending his records, and he now has USA-CA All Counties #472, 4-5-84, All 20 Meter Mobile, S.S.B.

George Dunn, WB0JYB, who already had USA-CA 2500, finished them up and had us send him All Counties #473, 4-9-84, Mixed.

"Jan" Molinari, N3ANX, also completed them all and has USA-CA All Counties #474, 4-11-84, All Mobile S.S.B.

Dave Popkin, W2CC, sent for USA-CA 3000 #502, 4-6-84, Mixed.

Chuck Imsande, W6YLJ, has upgraded his USA-CA Award to 1000 #836, 4-2-84, All 20 Meter Mobile, S.S.B.

Helmut Baumert, DL1QT, has resumed work on his USA-CA Award. On 12-4-61 Helmut received USA-CA 500 #42, All A-1. On 4-7-84 it was our pleasure to send Helmut the gold seal for USA-CA 1000 #838, All A-1.

Special Honor Roll
All Counties

#471 Father Terence Koch, K6HZI 4-2-84.
#472 Dean L. Molen, N7CYQ 4-5-84.
#473 George E. Dunn, WB0JYB 4-9-84.
#474 Jan Molinari, N3ANX 4-11-84.

USA-CA 500 certificates went to:

Father Terence Koch, K6HZI, 4-2-84, #1936, All 20 Meter Mobile, S.S.B.

Dean L. Molen, N7CYQ, 4-5-84, #1937, All 20 Meter Mobile, S.S.B.

DL0JK, Clubstation der Gesamtvolkshochschule Kassel (School for Adult Education in Kassel, West Germany), 4-5-84, #1938, Mixed.

Ely Camin, IN3VZE, #1939, 4-9-84, All S.S.B.

"Jan" Molinari, N3ANX, #1940, 4-11-84, All Mobile, S.S.B.

New Awards

The Polska Award: This new SP award called "Polska" is available in three classes: Class 3 for contacts with 30; Class 2 for contacts with 35; and Class 1 for contacts with 49. Contacts must be made after 31 May 1975. Wojewodztwos (provinces) of Poland contacts must be confirmed by QSL cards. QSL confirmation is not required when all contacts are made during the SP DX Contest (c.w. and s.s.b.) in the same year. Add separate application with abbreviations denoting the province. Provinces and abbreviations are as follows:

SP1: KO Koszalin, SL Slupsk, SZ Szczecin.

SP2: BY Bydgoszez, GD Gdansk, EL Elblag, TO Torun, WL Wloclawek.

SP3: GO Gorzow, KL Kalisz, KN Konin, LE Leszno, PL Pila, PO Paznan, CG Zielona Gora.

SP4: BK Bialystok, LO Lomza, OK Olsztyn, SU Suwalki.

SP5: CI Ciechanow, OS Ostroleka, PL

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W2CC	502
WB0JYB	503
N3ANX	504

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K6HZI	560
N7CYQ	561
N3ANX	562

2000	
K6HZI	613
N7CYQ	614
N3ANX	615

1500	
K6HZI	682
N7CYQ	683
N3ANX	684

1000	
K6HZI	835
W6YLJ	836
N7CYQ	837
DL1QT	838
N3ANX	839

500	
K6HZI	1936
N7CYQ	1937
DL0JK	1938
IN3VZE	1939
N3ANX	1940

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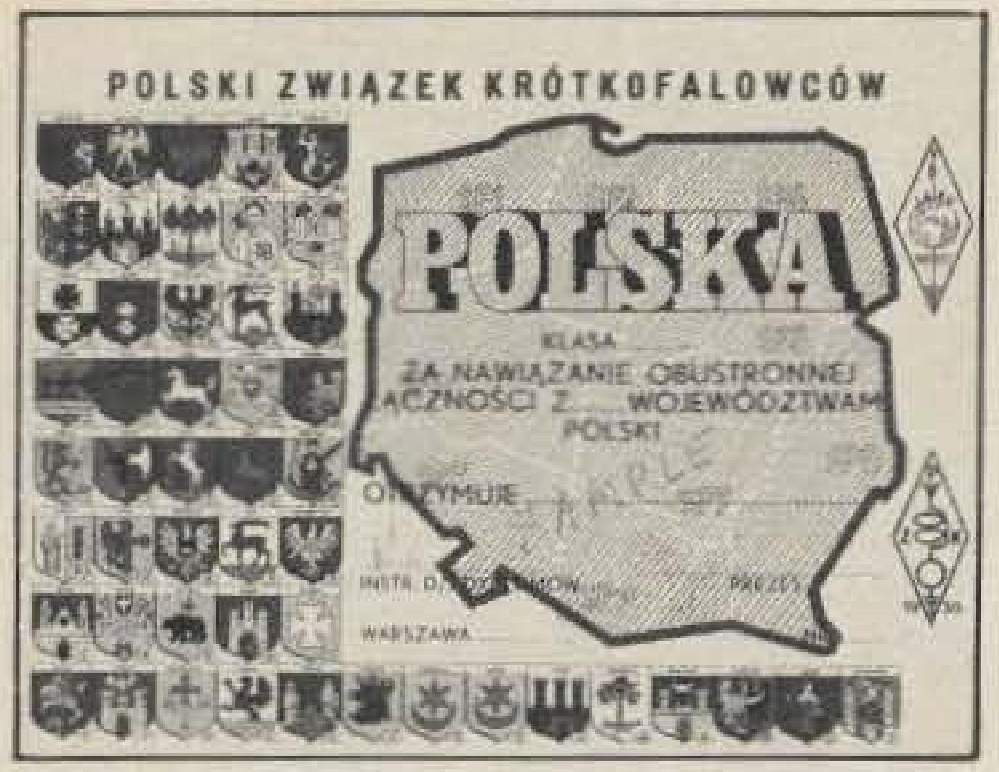
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POLSKA

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INSTR. D. PREZES

WARSZAWA

The Polska Award for working provinces in Poland.

Plock, SE Siedlice, WA Warszawa.

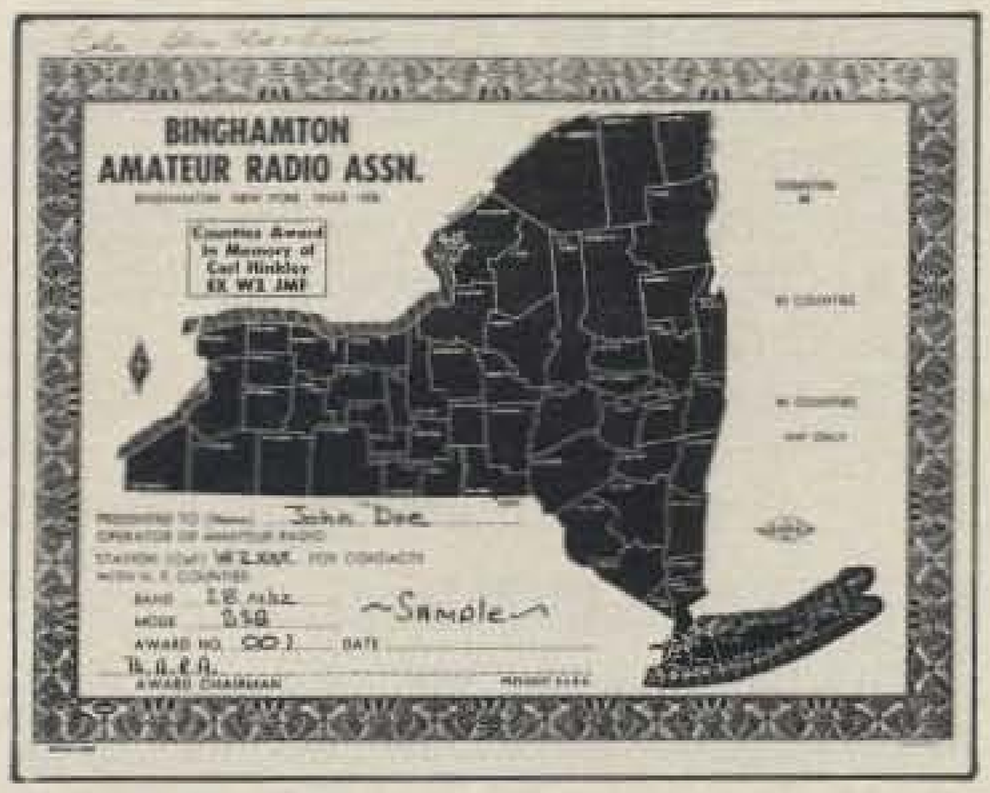
SP6: JG Jelenia Gora, LG Legnica, OP Ople, WB Walbrzych, WR Wroclaw.

SP7: KI Kielce, LD Lodz, PT Piotrkow Tr., RA Radom, SI Sieradz, SK Skierniewice, TG Tarnobrzeg.

SP8: BP Biala Podlaska, CH Chelm, KS Krosno, LU Lublin, PR Przemysl, RZ Rzeszow, ZA Zamosc.

SP9: BB Bielsko Biala, CZ Czestochowa, KA Katowice, KR Krakow, NS Nowy Sacz, TA Tarnow.

To apply send GCR list and fee of 10 IRC's to Award Manager PZK, Box 320, 00-950 Warszawa, Poland.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STATION (CALL) W2XXX FOR CONTACTS
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MODE SSB ~Sample~
AWARD NO. 001 DATE
B.A.R.A.
AWARD CHAIRMAN

BARA Award for working all New York counties.

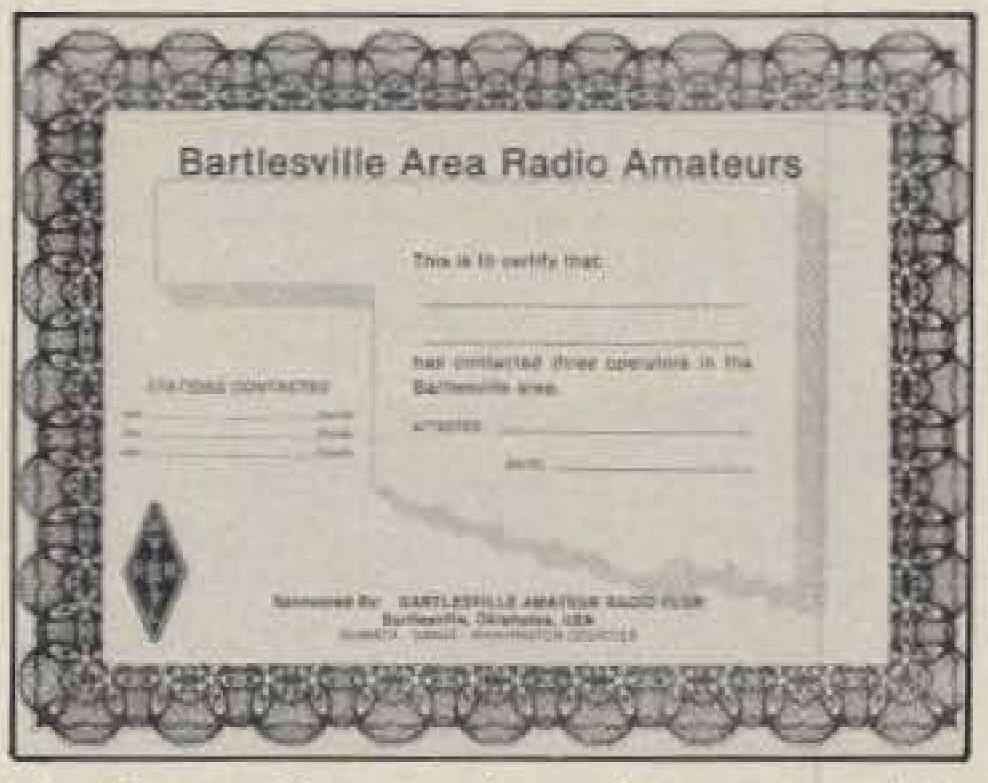
The WACONYS Award (Worked All Counties of New York State). This award is sponsored by the Binghamton Amateur Radio Association of Binghamton, New York. Work all 62 counties in New York State. To apply, forward proof of contact in the form of a list of the contacts showing callsign, time, date, frequency, mode, and signal report. The list must be verified by an official of your local radio club or by two licensed amateurs. On your application mention any endorsements for which you qualify.

The fee is $2.00 U.S. or equivalent. Send application and fee to BARA, P.O. Box 853, Binghamton, NY 13902.

The Green Country Award. A new operating certificate is now being offered by the Bartlesville (Oklahoma) Amateur Radio Club. The purpose of the certificate is to focus attention on the interesting "Green Country" region of northeast Oklahoma, and to emphasize the varied operating activities of the nearly 200 radio amateurs within that area.

The Green Country Award is available to anyone making two-way amateur radio contact with three hams in the Nowata, Osage, and/or Washington Counties of Oklahoma. All bands and modes are permitted. The certificates will be numbered and issued serially.

Applicants for the award should submit calls and pertinent details of their three qualifying QSO's, plus $1.00 handling fee. QSL's are not required. Applications should be mailed to W5NS Awards Manager, 18009 Moonlight Drive, Bartlesville, OK 74006, U.S.A.


Bartlesville Area Radio Amateurs

This is to certify that:

has contacted three operators in the Bartlesville area.

STATIONS CONTACTED

ATTESTED

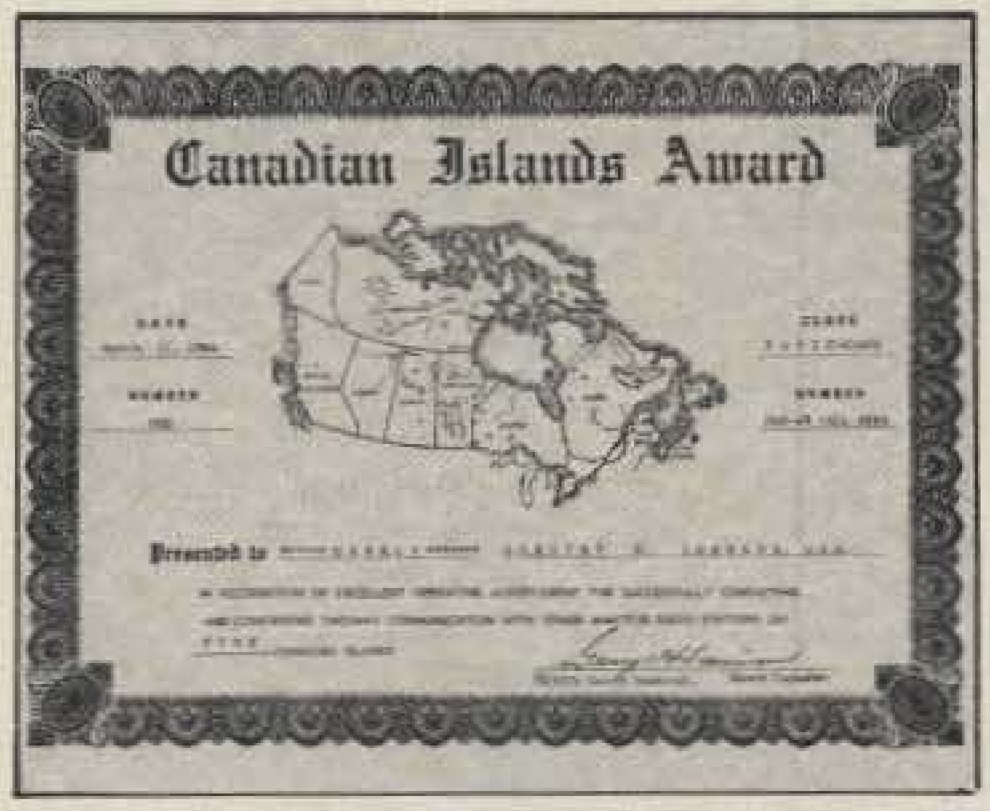
DATE

Sponsored By: BARTLESVILLE AMATEUR RADIO CLUB
Bartlesville, Oklahoma, USA
NOWATA · OSAGE · WASHINGTON COUNTIES

The Green Country Award, sponsored by the Bartlesville, OK, U.S.A., ARC.

Canadian Islands Award. Work different islands of Canada according to the following: Class IV, 5 islands; Class III, 10 islands; Class II, 15 islands; and Class I (Called Excellence), 20 islands of Canada. Send log data and $2.00 or 10 IRC's; do not send QSLs. The sponsor is Mr. Garry V. Hammond, VE3GCO, 5 McLaren Avenue, Listowel, Ontario, Canada, N4W 3K1. This award is in addition to the fine awards of the IOTA awards program of Geoff Watts, Norwich, England.

Canadian Islands Checklist: (1) Anticosti (VE2); (2) Baffin Island (VE8); (3) Belcher Island (VE8); (4) B.C. Offshore Island (VE7); (5) Cape Breton (VE1); (6) Ellesmore Island (VE8); (7) Georgian Bay Island (VE3); (8) Grand Manon Group


Canadian Islands Award

DATE

NUMBER

CLASS

NUMBER

Presented to

The Canadian Islands Award, sponsored by Garry Hammond, VE3GCO.

SAY GOODBYE TO TRAPS FOREVER!

SOMMER

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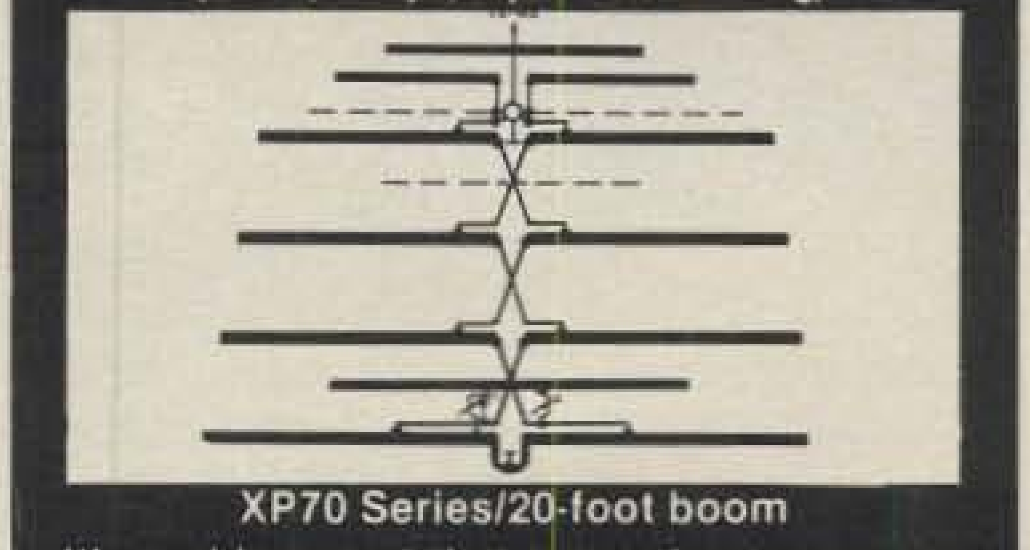
(U.S.A., Europe, Japan Pats. Pending)


XP70 Series/20-foot boom

It's no big secret that trapped antennas are poor compromises. Just ask one of the "big guns" why he is using monobanders! Ever since traps emerged in the 1950's amateurs have had to settle for compromise performance in their multiband antennas. That was, of course, until now...

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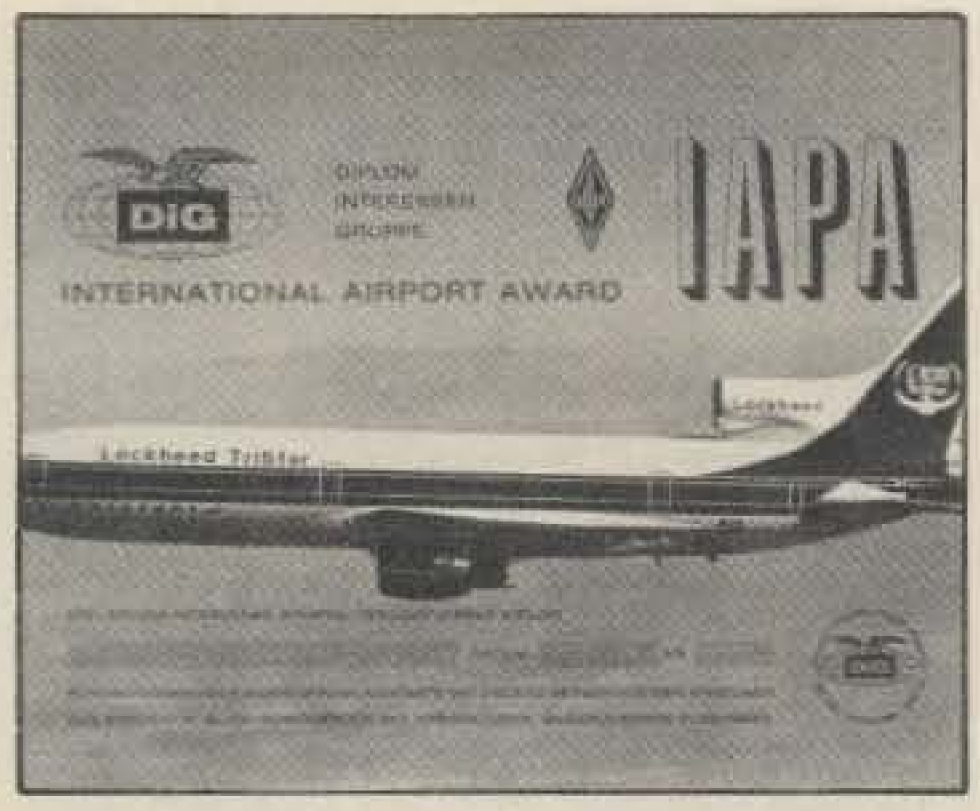
No-79-80

Club station of DLØJK, Adult College in Kassel, West Germany. Members recently received USA-CA 500 #1938.

Station of Helmut Baumert, DL1QT, origin of that FB c.w. signal from Germany. He has been in amateur radio 52 years.



DIPLOM INTERESSEN GRUPPE

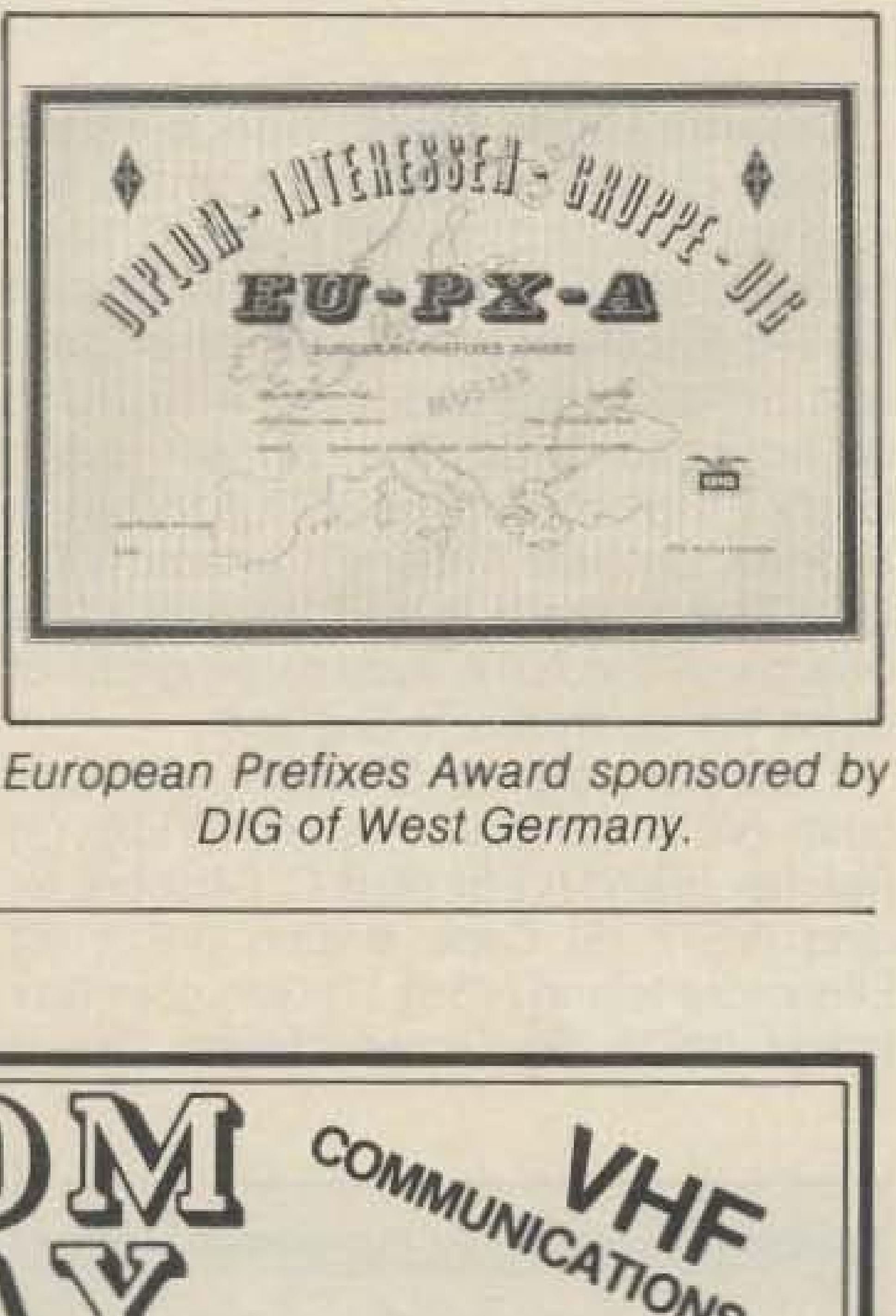
DIG

IAPA

INTERNATIONAL AIRPORT AWARD

Lockheed TriStar

International Airport Award sponsored by DIG of West Germany.



DIPLOM-INTERESSEN-GRUPPE-DIG

EU-PX-A

European Prefixes Award sponsored by DIG of West Germany.

(VE1); (9) James Bay Island (VE8); (10) Labrador Off-Shore Islands (VO2); (11) Lake Superior Islands (VE3); (12) Magdalin Island (VE2); (13) Manitoulin Island (VE3); (14) Montreal Island (VE2); (15) N.B. Off-Shore Islands (VE1); (16) Newfoundland (VO1); (17) Newfoundland Off-Shore Islands (VO1); (18) Northwest Passage Arch (VE8); (19) N.S. Off-Shore Islands (VE1); (20) Parry Islands Group (VE8); (21) Pelee Island (VE3); (22) Prince Edward Island (VE1); (23) Quebec Off-Shore Islands (VE2); (24) Queen Charlotte Island (VE7); (25) Sable Island (VE1 or VX9); (26) St. Paul Island (VE1 or VY); (27) Sverdrup Island (VE8); (28) Thousand Islands (VE3); (29) Vancouver Island (VE7).

International Airport Award. The IAPA is a beautiful award and is available to all licensed radio amateurs and s.w.l.'s who can prove contacts with licensed radio amateurs in 50 different cities with an international airport. Only one contact counts from the applicant's country. All six continents must be worked. Only contacts with fixed stations on or after 1-1-73 are valid. The award is available for contacts on all shortwave bands and modes (mixed) or for contacts only in c.w. for the C.W. Award.

No QSL's, only GCR list and fee of 7 DM or 10 IRC's sent to the Award Manager, Walter Hymmen, DL8JS, P.O. Box 1925, D-4980 Bunde, West Germany.

European Prefixes Award. The EU-PX-A is available to all licensed radio amateurs and s.w.l.'s who can prove contacts with 100 European stations with different prefixes. Prefixes in the sense of these rules (like WPX) are, for example, DL1, DL2, a.s.o. DJ1, DJ2, a.s.o. F1, F2, a.s.o., EA1, EA2, a.s.o., I1, IN3, IV3, a.s.o., OZ1, OZ2, a.s.o., YU1, YU2, a.s.o., HB4, HB9, HB0, a.s.o., UA1, UA2, a.s.o., all prefixes of European-Russian stations, and all special prefixes in Europe. All prefixes listed in the WAE and/or DXCC country list are valid.

The award is available for contacts on all bands and modes (mixed), for contacts only in c.w. (C.W. Award), or for contacts on the v.h.f./u.h.f. bands only (V.H.F. Award). Stickers are available for additional 50 prefixes. No QSL's, only GCR list and fee of 7 DM or 10 IRC's. Stickers, s.a.s.e. only. Send to the Awards Manager, Alfons Niehoff, DJ8VC, Ernst-Hase-Weg 6, D-4407 Emsdetten, West Germany.

(Note: Diplom Interessen Gruppe [Diploma Interests Group of Germany] has a fine awards program. Through the courtesy of Eberhard Warnecke, DJ8OT, DIG Secretary, we have received rules and samples of the awards and will be publishing them in this column. In the meantime, if you wish full information on the complete DIG Award Program, it is available in English, French, German, Japanese, Portuguese, Spanish, or Russian from DIG Secretary, Eberhard Warnecke, DJ8OT, P.O. Box 101244, D-5620 Velbert 1, Germany.)

New Awards Directory!

The third revised edition of the *Amateur Radio Awards Directory* has been updated from the original 1981 edition to include the rules, checklists, maps, and application forms for about 200 of the most popular and prestigious certificates, pins, diplomas, awards, and plaques. All continents and more than 70 countries are represented in the directory. The directory has an 8½" × 11", three-ring format for easy removal and addition of pages. The cost of the directory is $8.00 CDN for VE/VO/VY, $8.00 U.S. for W/K zip code addresses, $10.00 U.S. for standby airmail, and $13.00 U.S. airmail to all DX locations. Orders should be sent to Garry Hammond, VE3GCO, 5 McLaren Ave., Listowel, Ontario, Canada N4W 3K1.

Notes

In this part of the world summer travel is at its peak, children are happy to be free of school for another month, and we are all looking forward to one of the nicest times of the year—harvest time. I hope things are going well where you are.

73, Dorothy, WB9RCY

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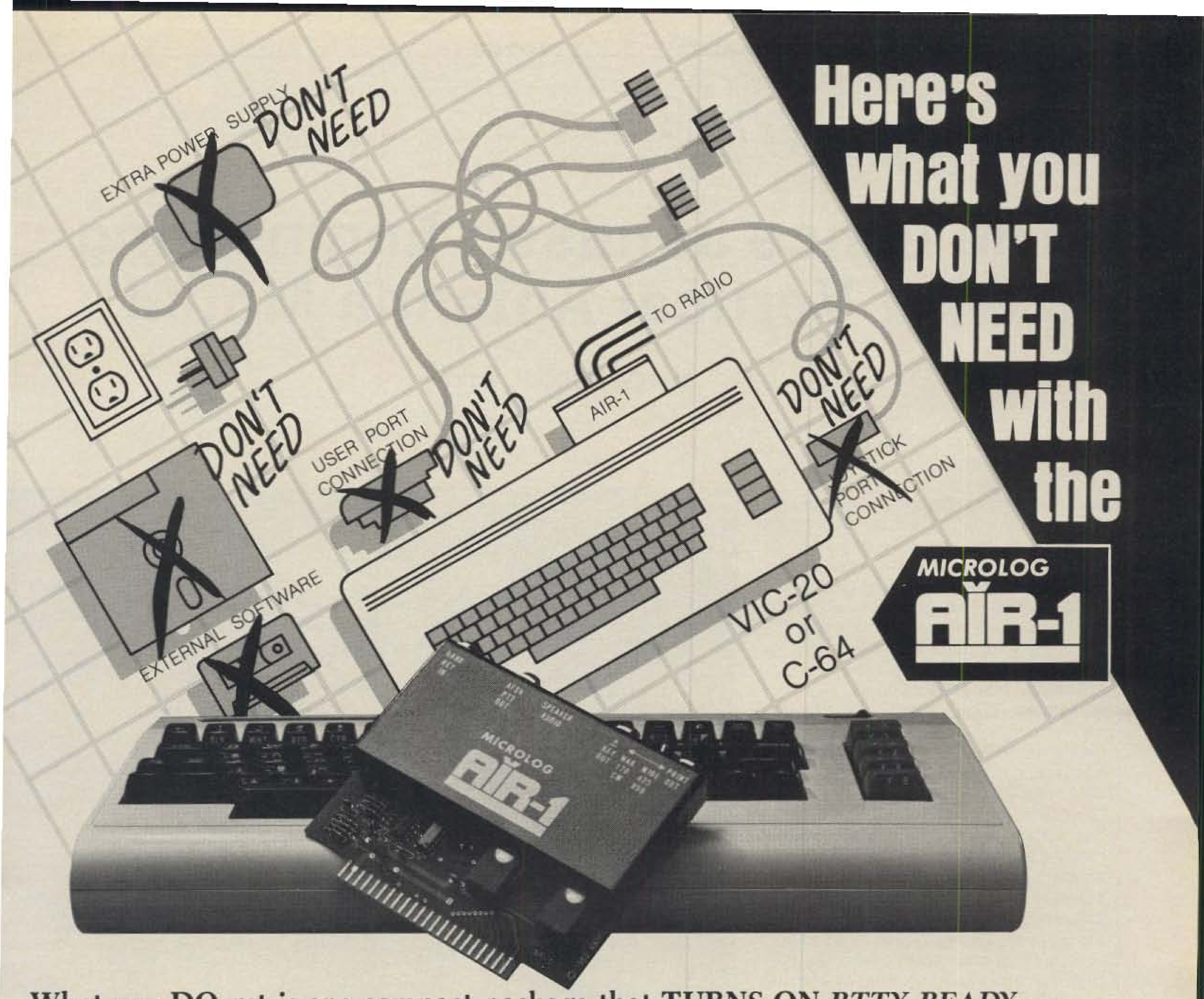
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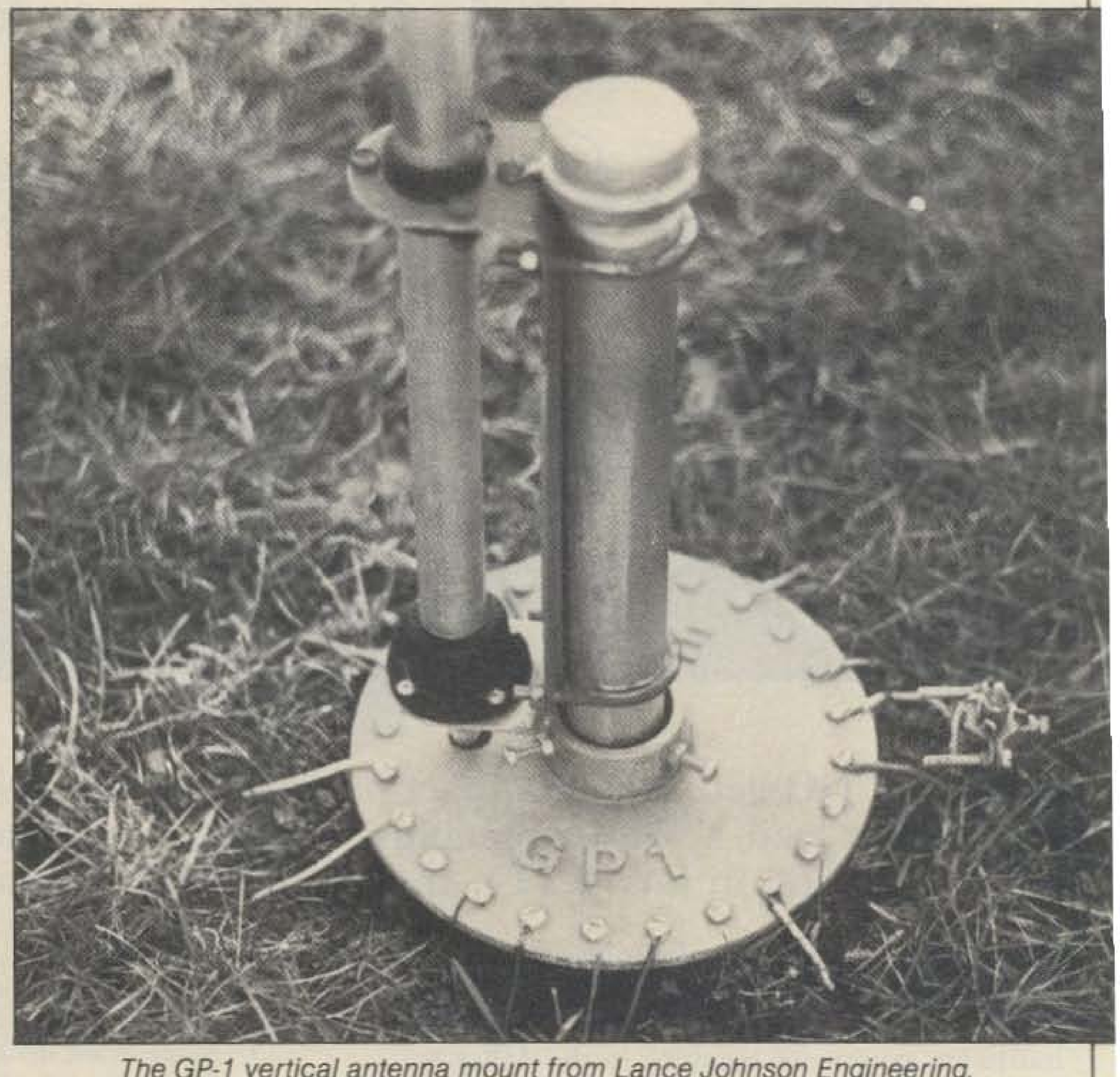
CQ REVIEWS:

The Lance Johnson Engineering GP-1 Vertical Antenna Mount

BY LEW MCCOY*, W1ICP



The GP-1 vertical antenna mount from Lance Johnson Engineering.

Lance Johnson Engineering of Kansas City, Missouri, has developed an antenna base mount that should be of interest to anyone thinking of installing a vertical antenna or ground system. The GP-1 is basically a mounting plate that serves the dual purpose of a mounting for your antenna (vertical) and a connection point for a multiple-wire ground system.

The GP-1 is a very rugged piece of equipment. It is made from cast "Alumaloy" and is ¼ inch thick and 10 inches in diameter. "Alumaloy" is a material that is about 90 percent aluminum and 10 percent magnesium. The photograph will give the reader an idea of what the GP-1 is. The center hole in the GP-1 will accommodate any mast size up to 2 inches in diameter, and there are three locking screws and nuts to hold the mast (or vertical). Around the perimeter of the mounting plate are 24 heavy-duty bolts to hold the radial system. Anyone who has ever tried to make a radial ground system will quickly see the beauty of the GP-1.

Although this is a product review, I would like to mention a few things about radial systems. First, a few years back several articles dealing with shortened verticals and ground systems were written by Dr. Jerry Sevick of Bell Labs. Those articles, which appeared in *QST*, are recommended reading. In addition, I recommend the original reference used by all antenna people in discussing ground systems: "Ground Systems as a Factor in Antenna Efficiency," by Brown, Lewis, and Epstein. The article appeared in the June 1937 Proceedings of the IRE (your library should be able to get you a copy). Another very excellent article on the subject of radials is the one written by Arch Doty, K8CFU, in the April 1984 issue of *CQ*. As Arch points out, radials should not be buried, or if they are, they should be made of insulated wire and buried no more than just a soil covering. The GP-1 lends itself to this type of insulation.

As has been pointed out many times in the past, the radial system should consist of 40 or more radials at least two-tenths wavelength long to really be effective. This translates into radials 50 feet long on 80 meters. It also should be mentioned that *any* ground radial system with a vertical is better than none at all. Many amateurs say that they cannot get 50 feet of wire run out from the base of the vertical. I know from my own experience and that of others that it is possible to "bend" radials to fit the area, getting down as much wire as possible. The GP-1 has 24 radial bolts, so it is an easy matter to put two radials under each bolt to make a total of 48 radials. Another point: You don't necessarily need large-diameter wire for the radials. The antenna currents are going to be distributed over all the wires, so the radials can be made from relatively small diameter wire, such as No. 18 or No. 20.

The GP-1 will fit inside a tower that has an inside dimension of at least 10 inches (for example, the Rohn 25). Lance Johnson sent along an interesting antenna

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Technical Consultant, CQ, 200 Idaho St., Silver City, NM 88061

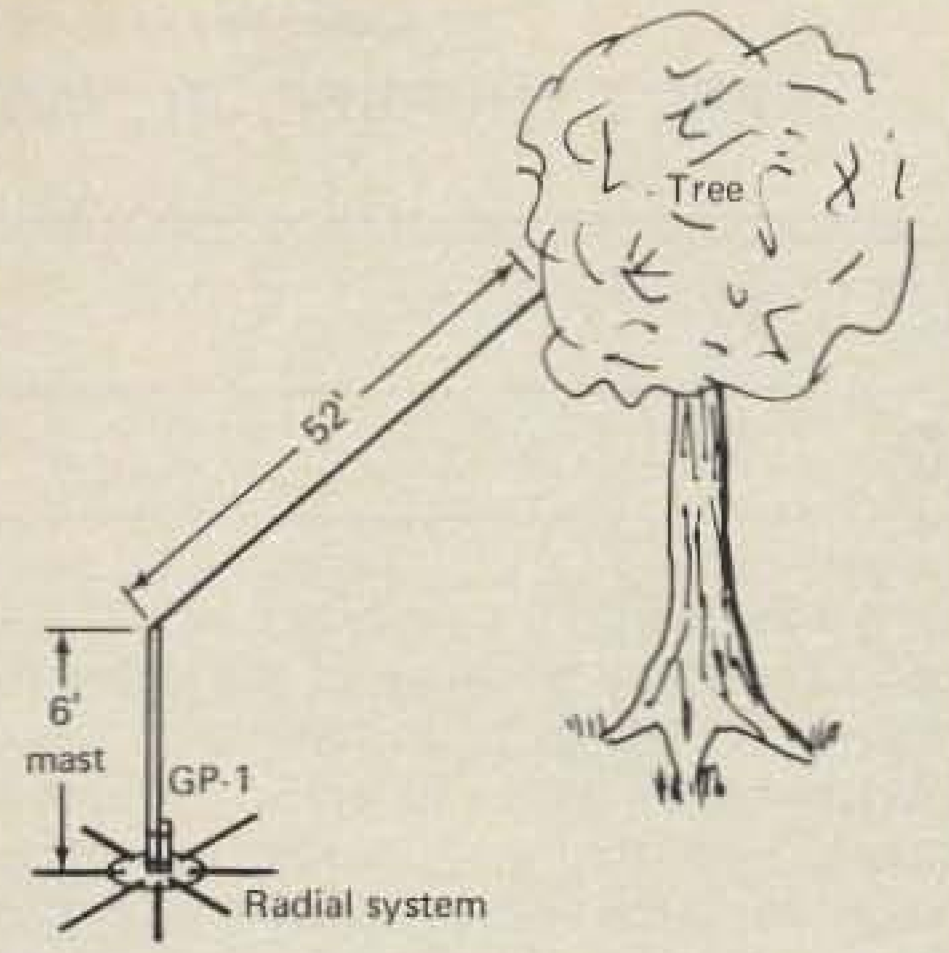

Fig. 1– A sketch of the antenna mentioned in the text. The feed impedance will be close to 50 ohms.

that he constructed using the GP-1, and it is worth passing along. The antenna is shown in fig. 1. The antenna uses 6 feet of aluminum tubing and then 52 feet of No. 12 copper wire to the top of a tall tree (using an end insulator, of course). He says he has worked 38 zones with the antenna on 75 and 162 countries! That has to be a good antenna, don't you agree?

If I get the time, I hope to use the GP-1 for a multiband vertical system which will be described in a future issue of *CQ*.

The GP-1 costs $24.95 postpaid from Lance Johnson Engineering, P.O. Box 7363, Kansas City, MO 64116. CQ

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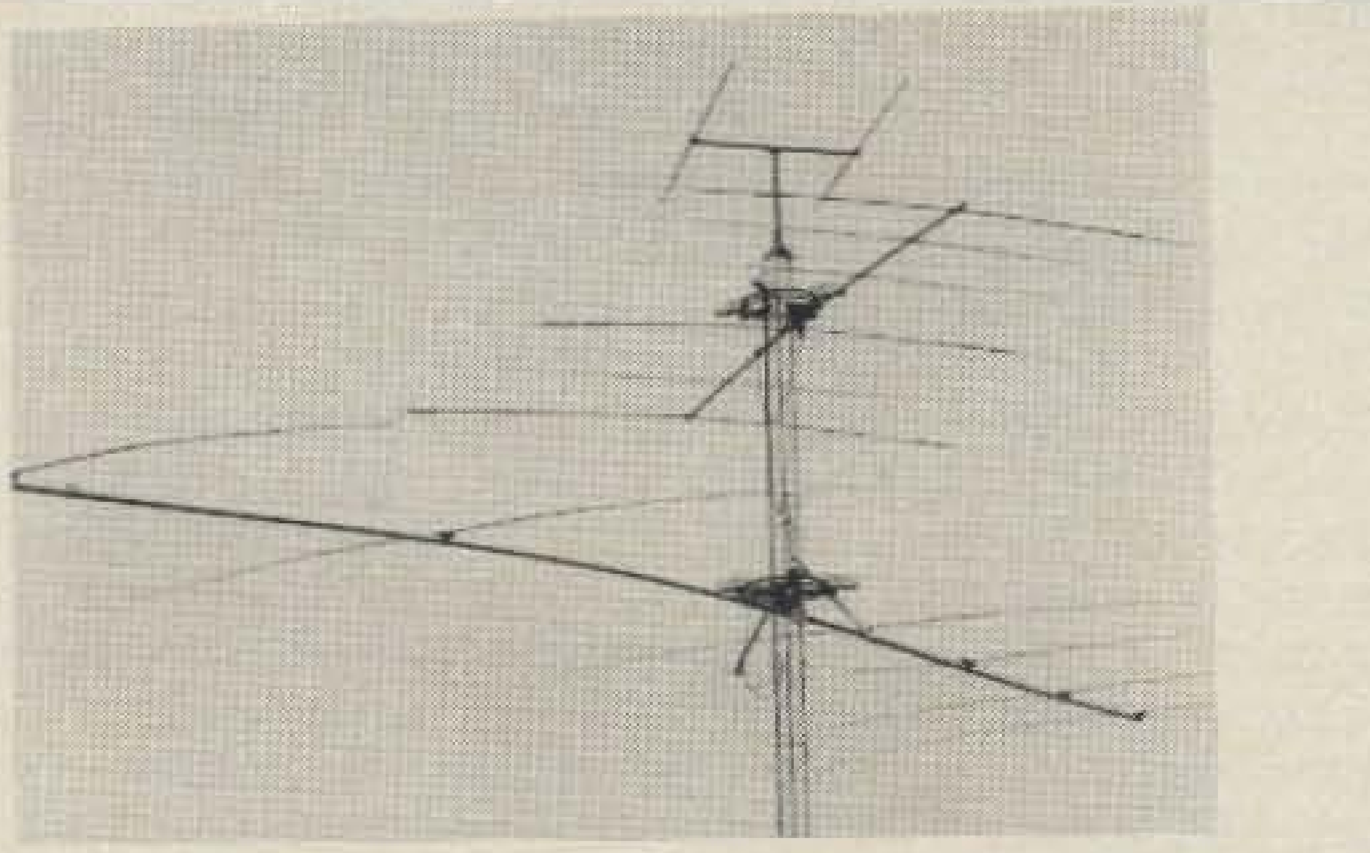

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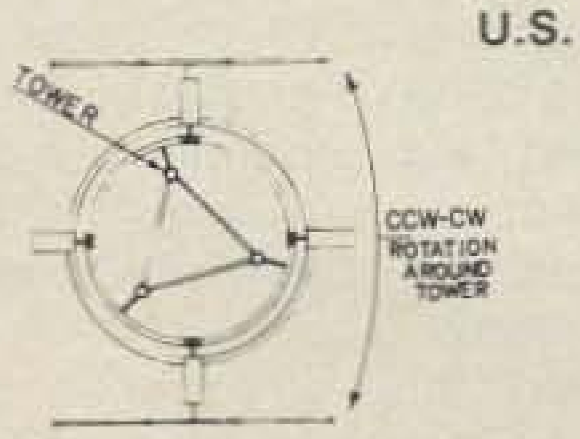

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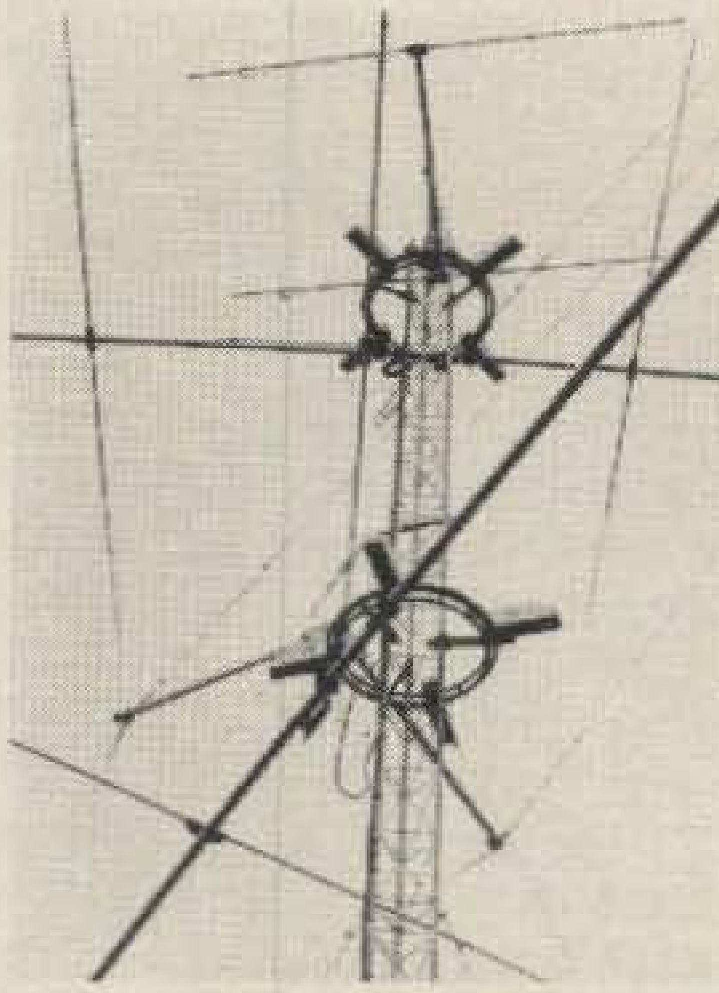

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Antennas

a monthly feature by
KARL T. THURBER, JR., W8FX

DESIGN, CONSTRUCTION, FACT, AND EVEN SOME FICTION

Reader Recap—Part Two

Last month columnist W8FX opened the mailbag for a recap of recent column correspondence. He also introduced several new and interesting topics. He continues in the same vein this month.

In last month's Antennas column we presented a forum of reader mail received over the past few months. We also took note of some doings on 1750 meters and discussed some new amateur computer software.

It turns out that we didn't finish up all of the mail last month, so we'll continue our reader forum with several additional letters we believe you'll find interesting. We'll also highlight two excellent computer programs from RAK Electronics and sample some Timex-Sinclair software offerings from Kentronics. Let's first look at the letters.

Into the Mailbag

While the column often touches on very complex, often unusual antennas, we actually receive the greatest volume of correspondence on the simpler h.f. types—dipoles, verticals, and single-wires—perhaps reflecting *CQ*'s interest in the needs of beginning hams. A typical query is represented by this letter from beginner L. B. "Lin" Leighliter. We'll excerpt a portion of his letter here.

"As a prospective Novice about to take both tests, I'm in the process of getting an antenna up, and I have a question. I would appreciate your time, as I'll be saved time and aggravation."

"Planning to work 15 meters off of a 40 meter dipole, how can I avoid s.w.r. problems for one band when making s.w.r. (cutting and trimming) adjustments on the other? And correct me if I'm wrong, but I believe I can cut the dipole for 7.125 MHz for 7.100 to 7.150 MHz operation, and still work 21.100 to 21.200 MHz. The objectives I have in mind are to have a duo-band dipole resonant at 7.125 MHz, usable from 7.100 and 7.150 MHz, and resonant also at 21.150 MHz, usable from 21.100 to 21.200 MHz."

We advised Lin that it's an established fact that the dipole will accept power nicely at odd harmonics of the operating frequency. This means that a 7 MHz dipole will display a low feedpoint impedance at 21 MHz and can, therefore, usually be fed directly or through a balun with 70–75 ohm coaxial cable. An antenna tuner or transmatch should not be required in most circumstances.

When feeding such an antenna on "odd harmonics," it's a good idea to favor the higher band when pruning the antenna to resonance. Thus, I would consider the 15 meter resonance to be the primary one, cutting the antenna for best results at the midpoint of the desired operating range, or 21.150 MHz. This would drive the 40 meter resonance slightly below the desired range, but this should result in few adverse effects.

Actually, if one is interested in improved operating bandwidth, a folded dipole may represent a better choice than a conventional dipole. We won't go into detail on folded dipole theory and construction here, as we've covered this area before in the column, and most antenna manuals have extensive folded dipole design coverage. But reiterating a few key points concerning this type of antenna will be useful here.

The folded dipole has a "flatter" operating characteristic (impedance versus frequency) than does the ordinary dipole. The result of this is that it's possible to operate over a broader band of frequencies with a low s.w.r. than with the conventional dipole. The two-wire folded dipole is particularly useful, since the feedpoint impedance is close to 300 ohms, meaning that it can be fed directly with 300 ohm twinlead, or through a 4:1 balun for coax feed, for low s.w.r. operation.

While the folded dipole won't accept power on *even* harmonic frequencies, it will do so on *odd* multiples of the antenna's design frequency, as will a simple dipole. Like its simpler cousin, a 3/2 wavelength folded dipole will "look like" a half-wavelength dipole as far as the transmitter and transmission line are concerned. As a result, a 40 meter folded dipole can be used to good advantage for third harmonic operation on 15 meters, with exact resonance somewhat less critical than in the case with the simple dipole. Other odd harmonic operating relationships can be used, too, with some amateurs reporting acceptable results with 80 meter folded dipoles on the new 30 meter band, where a similar ½ versus 3/2 wavelength relationship exists.

Several topics were brought up in correspondence with David Myrick, W3DBA. Dave first wrote to us asking our advice on ⅝-wavelength h.f. verticals, which are popular largely because of the approximately 3 dB gain experienced over ¼-wavelength types. Specifically, Dave inquired as to the optimum mounting height for such verticals, whether or not 40 and 20 meter folded dipoles fed with 450 ohm line would be advisable, and whether an openwire, base-fed ⅝-wave vertical would be inviting feeding troubles. Point by point, our observations on these three questions are as follows.

1. It's true that the half-wave vertical works best from an angle of radiation standpoint when mounted with its bottom end 0.1 to 0.2 wavelength above ground. However, I'm not aware of any specific guidance on the optimum height above ground for the ⅝-wave vertical. In the case of true gound-mounted verticals, the quality of the buried radial and rod system has a very direct bearing on antenna efficiency, and few amateurs have the facilities or inclination to install the many radials usually required to obtain a truly low-resistance ground path.

The ground plane often results in a better choice, as the "ground" characteristics are more controllable, the influences of the actual "earth" and associated soil conditions are minimized, and the radials normally are much easier to install. To get back to W3DBA's question, many radials are required for best results with a zero-height antenna (as many as 100 or more!). However, fewer radials are required as the antenna's base is elevated above ground, to a point where at a base height of about ½ wavelength, only three to five radials should suffice. Additionally, if the radials are allowed to droop at an angle (normally 45 degrees), a very slight gain over a normally-configured vertical is realized (well under 1 dB, however). More importantly, by allowing the radials to droop, the feedpoint impedance of the ground plane is raised slightly (from about 30 ohms to 50 ohms). This, of course, makes direct coax feed a simple matter.

2. On Dave's second point, vertical folded dipoles for 40 and 20 meters are quite reasonable, although of course separately constructed antennas would be required for each band due to the even harmonic relationship which exists between the two bands. Feeding individual folded dipoles with nonresonant (untuned) 450 ohm openwire line should result in no feeding problems, although a transmatch would be required on the hamshack end. If an impedance ratio greater than 4:1 is desired, as in the case

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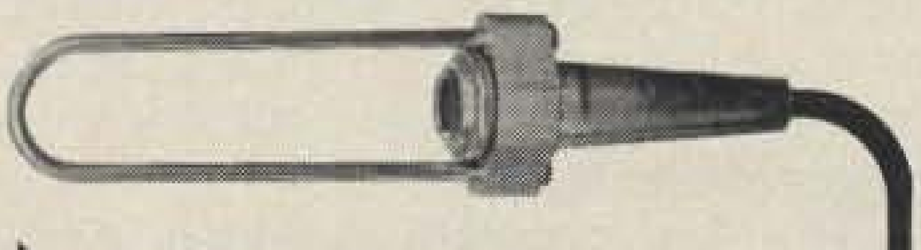

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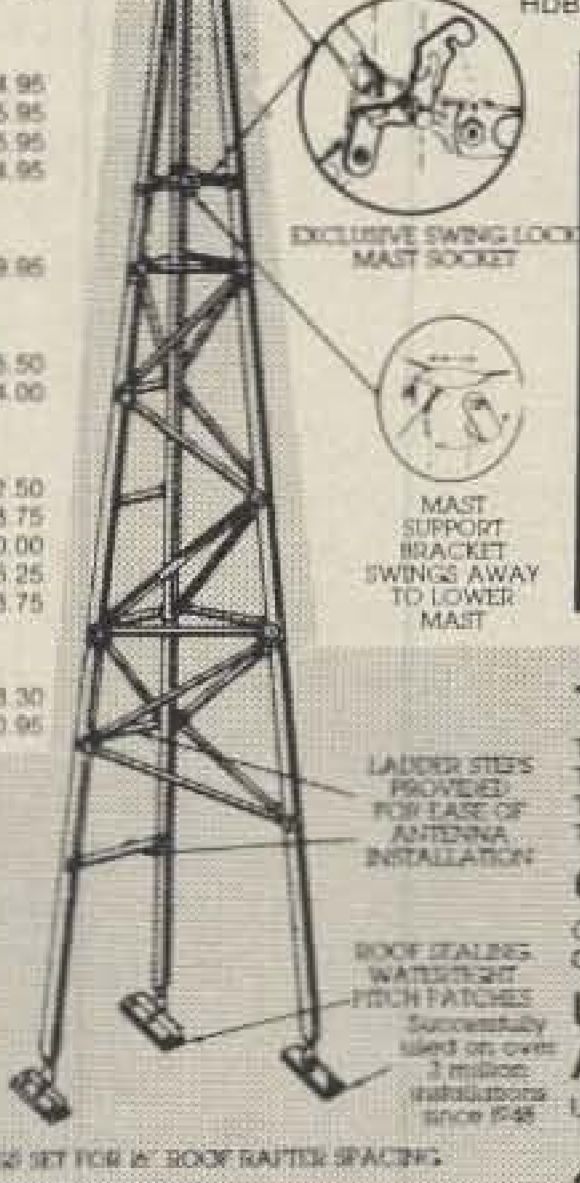
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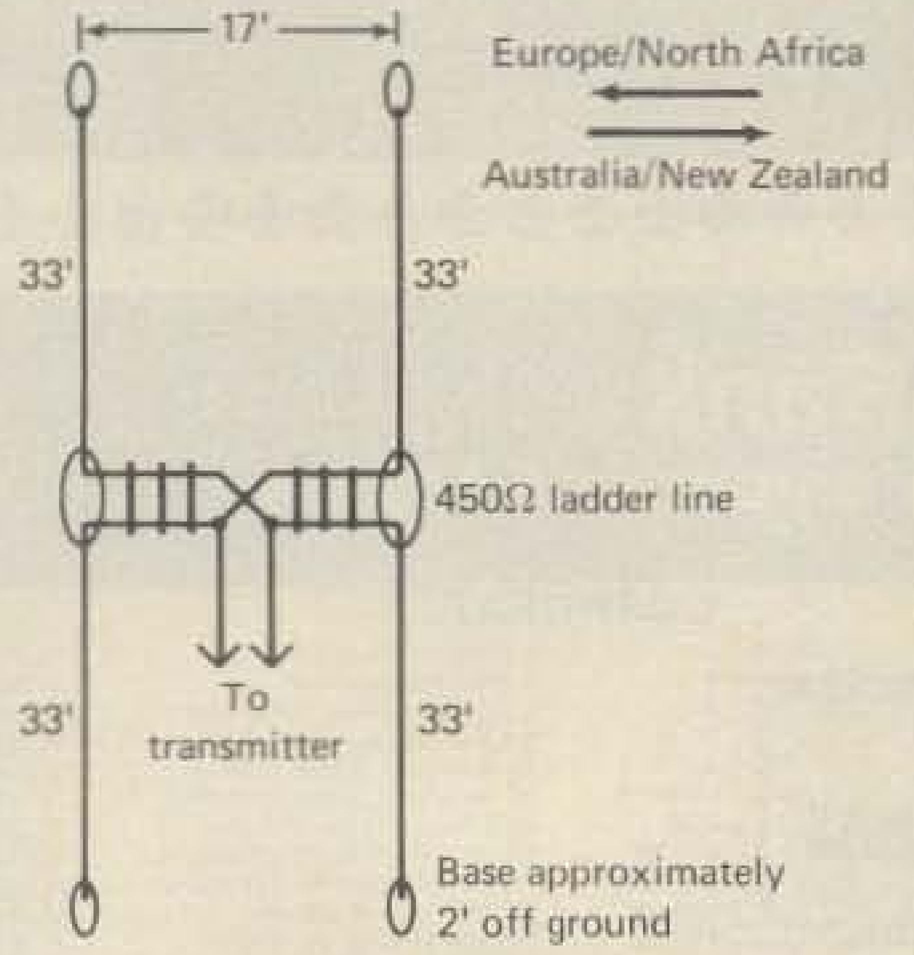

Fig. 1– Shown is W3DBA's vertical W8JK flat-top beam. W8JKs are normally mounted in the horizontal plane, but they can be installed vertically, too. W3DBA advises that with the vertical installation at his QTH the expected gain of about 4 dB on 40 meters and 6 dB on 20 meters did not seem to materialize, although side attenuation appeared to be excellent. His antenna functions as a single-section array on 40 and a two-section array on 20 meters. Although W8JKs are normally center-fed, they may also be end-fed. This would be particularly advantageous for vertically installed arrays, where end- or base-feeding would be more convenient than center-feeding. For details on specialized W8JKs and related combination driven arrays, consult the ARRL Antenna Book *or Bill Orr's* Radio Handbook, *where a variety of configuration details are provided.*

of feeding with 450 or 600 ohm openwire line, however, one might want to experiment with a three-wire folded dipole. Using three equal-diameter conductors should produce an impedance step-up of 9:1, or around 650 ohms at the feedpoint. Such an antenna will be even broader in frequency response than the typical two-wire folded dipole.

3. On Dave's last point, base feeding the vertical with 450 ohm line is feasible, but I recommend against doing so. The vertical is essentially an unbalanced, low-impedance antenna, whereas openwire line is balanced and constitutes a relatively high-impedance transmission line. Without special attention to balancing and impedance matching, results are likely to be unpredictable. Many of the problems associated with end-fed Zepps and singlewires may surface with such an arrangement, including feedline radiation, various matching difficulties, "r.f. in the shack" woes, and the like.

In a subsequent letter Dave brought to our attention his version of the classic W8JK beam. He recently transformed his half-wave 40 meter vertical into a vertical W8JK for both 40 and 20 meter operation. Dave's antenna is shown in fig. 1. As can be seen, he fed the two-band antenna at the center with 450 ohm resonant (tuned) openwire, although it's also possible to feed the antenna at the bottom for convenience.

The W8JK antenna is named in recognition of the amateur callsign of antenna pioneer John D. Kraus. It is known as a "driven flat-top beam," being made up of two closely spaced dipoles or collinear arrays. The W8JK produces a bidirectional pattern on the fundamental design frequency and, for single-section versions, on the second harmonic. Multiple-section versions produce a cloverleaf pattern on second and higher harmonic frequencies. The W8JK is normally mounted horizontally. However, it can be hung vertically as was done by W3DBA, and it can even be rotated if desired. Depending on spacing, 4–8 dB gain over a dipole should be achieved: about 4 dB for the single section array, and up to 8 dB for the four section. Typical spacings used are 0.15 to 0.25 wavelength.

The W8JK normally works well on even harmonics, although some have reported acceptable results using a triband design. We would suggest using the same flat-top lengths, but somewhat closer spacing—around 8–9 feet—if triband (20/15/10) meter operation is being considered. Alternately, if single-band operation is what you have in mind, consider constructing each dipole section in folded dipole format for easier-to-tame s.w.r. or use matching stubs if it is desired to have a fairly "flat" transmission line. (There are many variations of the W8JK and related combination driven arrays. Consult the *ARRL Antenna Book* or Bill Orr's *Radio Handbook*, where a variety of configuration details are presented.)

In the column for last June we mentioned the controversial Double Bazooka antenna, a coax-fed antenna that is said to offer wideband operating characteristics. The antenna, as we described it in the June 1983 column on p. 103, consists of a section of coax opened at the center, with the coax feedline being connected at that point, and end sections made of openwire line or twinlead. Based on considerable technical analyses of the antenna's claimed performance by several antenna authorities, we believe the Double Bazooka to be discredited as an antenna that provides significantly better bandwidth than the ordinary dipole. We presented this conclusion in the February 1984 column, and mentioned that the antenna has not been published in the *ARRL Antenna Book*, and although the antenna was once described in the ARRL's *Radio Amateur's Handbook*, it is no longer printed in recent editions.

While we're not advocating the construction of Double Bazookas, based on the preponderance of technical analyses which would tend not to support the claims for its performance, we asked for, and continue to receive, reports from readers who have constructed Double Bazookas. Generally lacking in such reports is rigorous analysis and side-by-side comparison with a reference dipole operating under identical conditions.

While the evidence would suggest that wide operating bandwidth results from the Double Bazooka are more the result of good luck and chance than technical design, we receive an interesting letter from Otis A. Nunn, Jr., KA4DHP. Excerpting from his letter:

"In your June issue, the Double Bazooka antenna was mentioned, and you asked for comments from those who built and used them. Here is the way I built mine, and some of the initial findings on its use.

"I used the design formula in the article, and the frequency I used was 7.225, which is, of course, the center of the 40 meter phone band for Advanced licensees. I used RG-58 for the center portion and TV twinlead for the ends. The center conductor was a Van Gorden round insulator with an SO-239 connector in the bottom."

Skipping over most of KA4DHP's construction details, which minimized some of the mechanical problems that the antenna's construction entails, KA4DHP advised that he did not use end insulators, but rather simply placed his nylon tie-off line about 4 inches up from the ends of the twinlead and securely taped them in place.

Results? The s.w.r. at the design frequency, 7.225 MHz, was measured at 1.6:1; at 7.150 the s.w.r. was slightly less, 1.3:1; and at 7.300 it was 1.9:1. For Navy MARS work on 7.3675 MHz, s.w.r. was 2.5:1. Installed as a slightly bent inverted Vee, the antenna reportedly works well on both transmitting and receiving.

We thank KA4DHP and others for the trouble to report their impressions in constructing and using Double Bazookas. We think, however, that the bandwidth obtained is not perceptibly greater on this type of antenna than that obtained from a simple, conventional dipole, and the dipole is a great deal simpler to construct. If you're leaning toward constructing a Double Bazooka from an improved bandwidth standpoint, consider the folded dipole. This antenna is a proven performer, and not much more difficult to construct than its basic cousin.

Two From RAK

We recently had the opportunity to acquire some "hands on" experience with two technical amateur radio computer programs from Richard A. Knox, WR4K, of RAK Electronics. Both programs were designed by Eugene Morgan, WB7RLX, and we think that both should be of interest to column readers. We'll share our impressions here.

The first program is simply entitled "Antenna Design," and it is available for both the Commodore 64 and Vic-20 computers (we examined the 64 version). The

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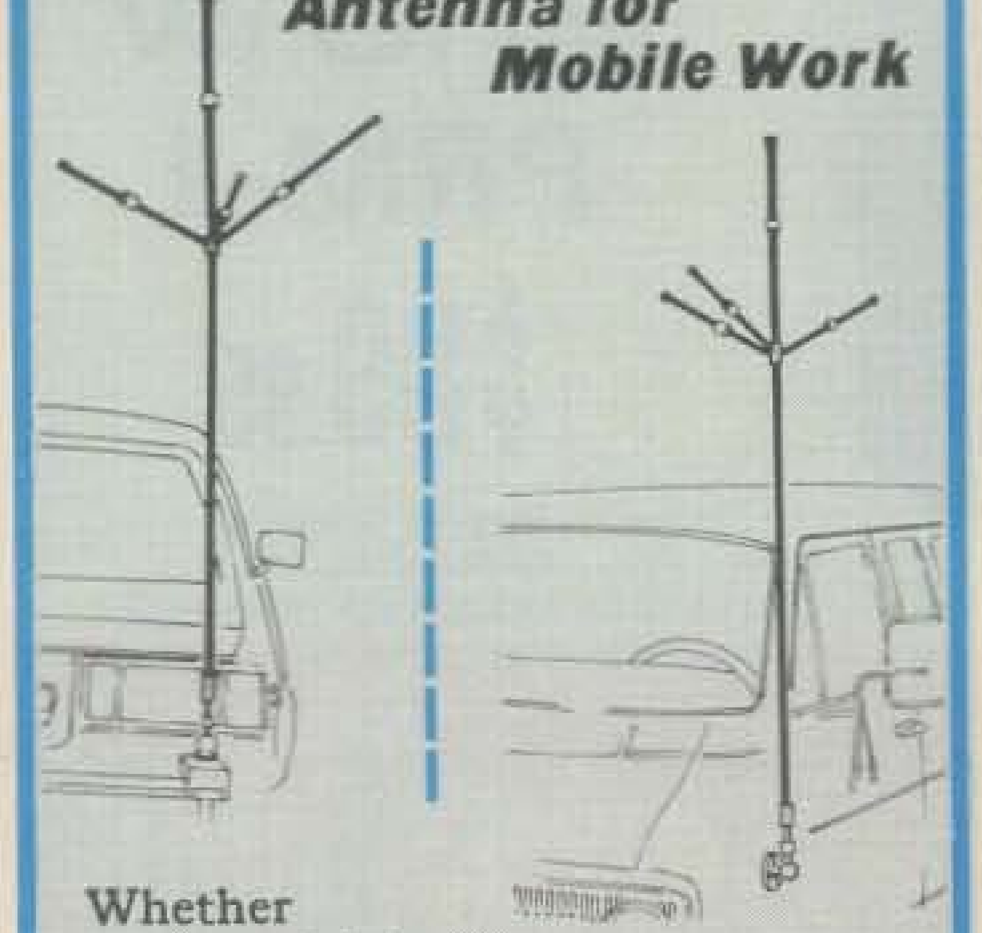

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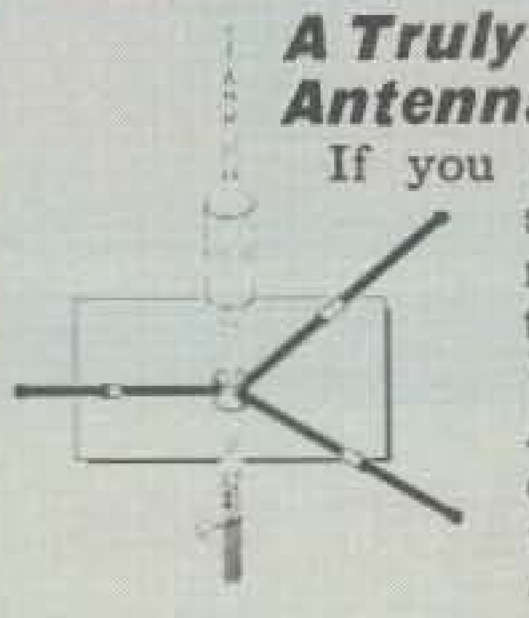

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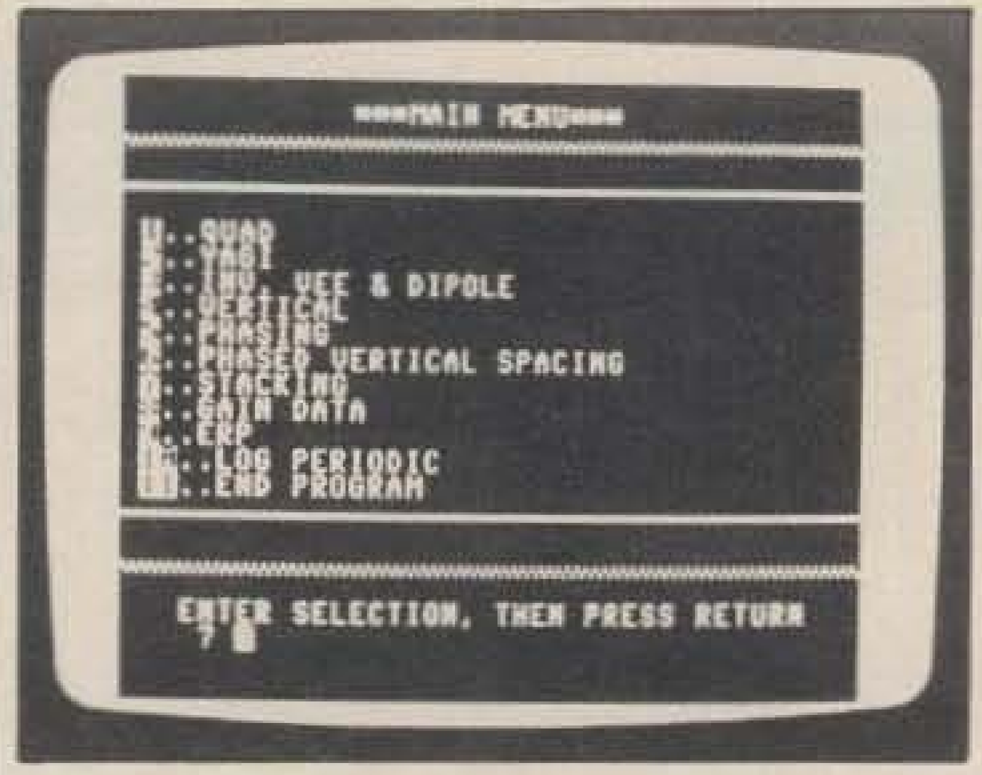
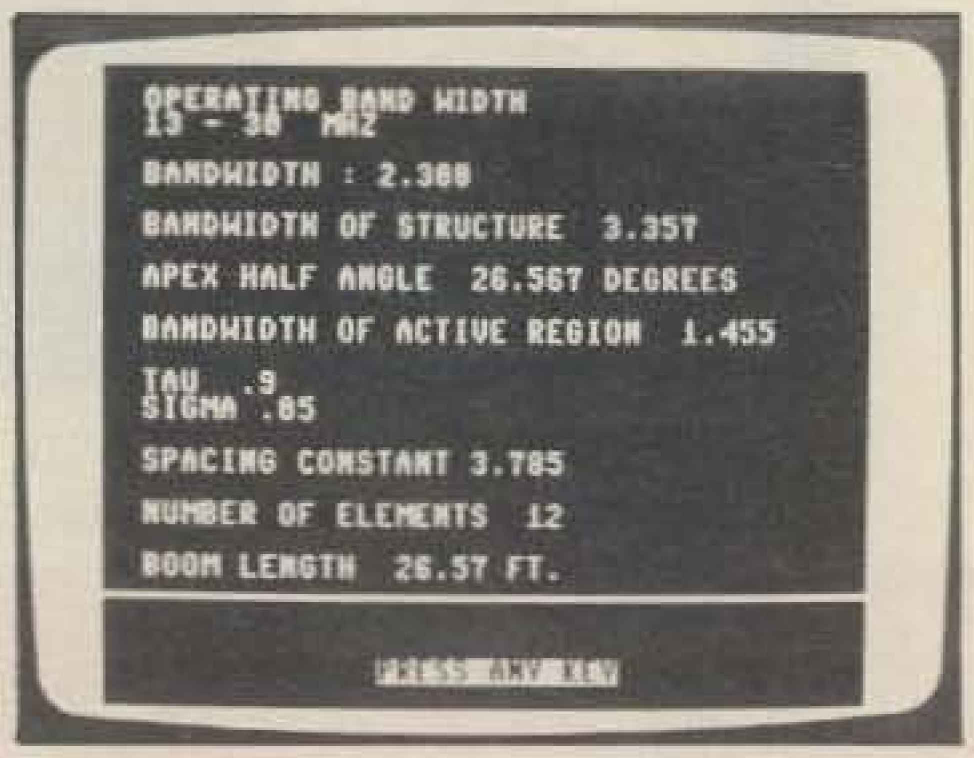


```
MAIN MENU
..QUAD
..YAGI
..INV. VEE & DIPOLE
..VERTICAL
..PHASING
..PHASED VERTICAL SPACING
..STACKING
..GAIN DATA
..ERP
..LOG PERIODIC
..END PROGRAM

ENTER SELECTION, THEN PRESS RETURN
 ?
```

Main menu of the RAK Electronics Antenna Design program created by Eugene Morgan, WB7RLX. Note the 10 major program functions, plus an exit routine. Program reviewed is for the Commodore 64, but a similar Vic-20 version is also available. (W8FX photo)



```
OPERATING BAND WIDTH
13 - 30  MHZ

BANDWIDTH : 2.308

BANDWIDTH OF STRUCTURE  3.357

APEX HALF ANGLE  26.567 DEGREES

BANDWIDTH OF ACTIVE REGION  1.455

TAU  .9
SIGMA .05

SPACING CONSTANT 3.785

NUMBER OF ELEMENTS  12

BOOM LENGTH  26.57 FT.

PRESS ANY KEY
```

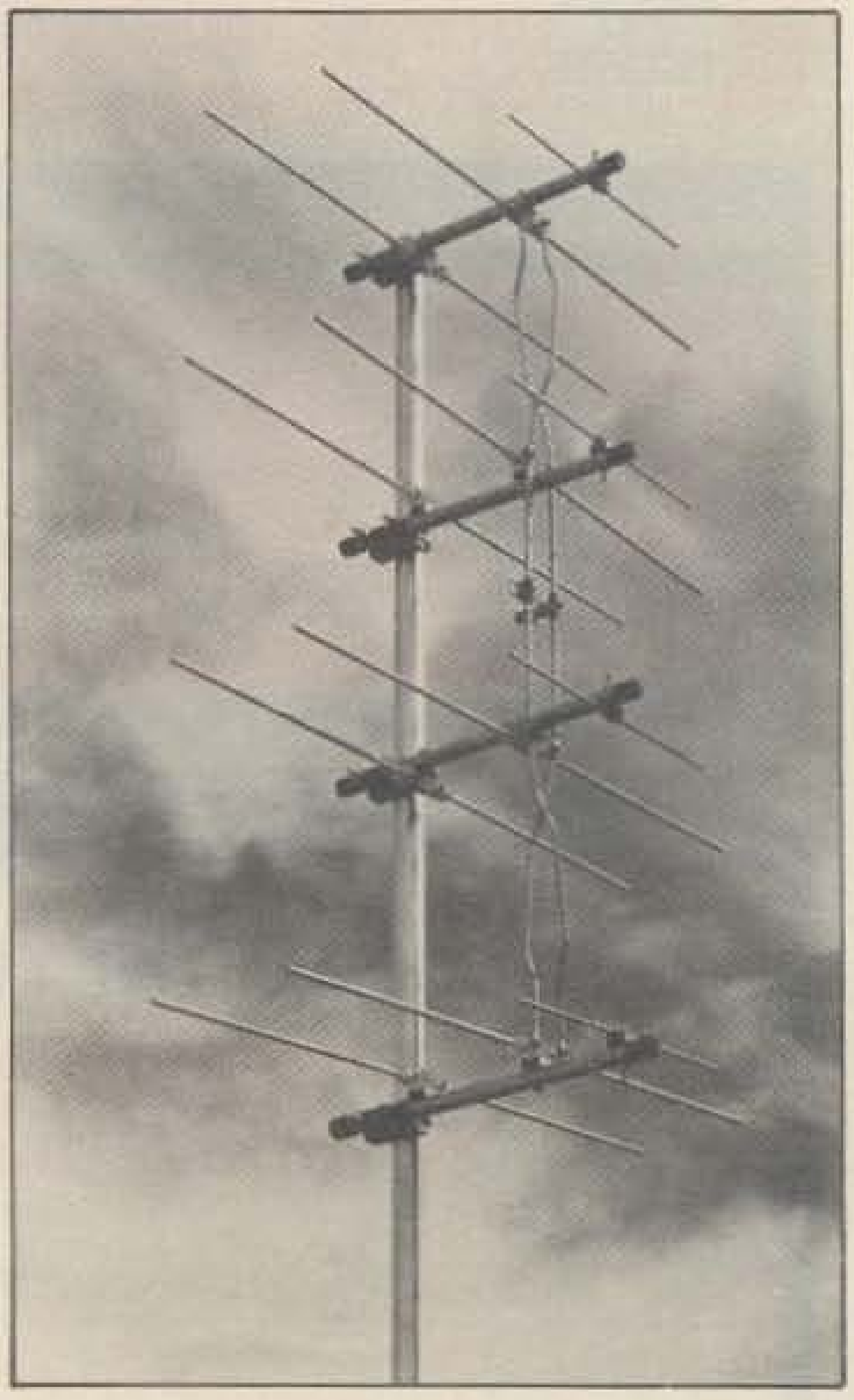
Screen photo of the Antenna Design program showing some of the information produced when Menu Selection #10, "Log Periodic," is chosen. Because of the amount of information to be displayed, the remainder of the computational data is displayed on subsequent screens. Hence the "press any key" prompt. (W8FX photo)

WB7RLX antenna design program, marketed by RAK, is one of the more comprehensive such programs we have seen for the personal computer market. The program was designed to give the antenna builder the proper sizes for the planning and construction of a wide range of antenna arrays. These include quads and delta loops, Yagis to 11 elements, dipoles, inverted Vees, verticals, and log periodics. In addition, the program covers several useful routines required in the planning and construction of multi-antenna arrays, such as phasing lines, phased vertical spacings, and stacking.

The program also includes routines that help to calculate antenna performance; these include effective radiated power (ERP) calculation and predicted gain data. Harmonic frequency displays are also provided for the dipole and inverted Vee. The program was designed to support the Commodore Vic-1525 printer, but it works well with other suitably interfaced printers, and you can still use the program if you don't own a printer.

In experimenting with the Antenna Design program, I found it to be professionally written and based on a synthesis of research into often conflicting technical literature on antenna design factors and dimensions. The author of the program recognized, for example, that there are as many different ways to design Yagis as there are books on the subject; he tried to collect as much information as he could about Yagi design, using as principal sources the *ARRL Antenna Book* and government studies, such as Viezbicke's National Bureau of Standards antenna design technical paper (see bibliography).

A particularly interesting menu choice the program offers is that of designing a Log Periodic array. When selecting this option from the menu, you are first asked if you want the computer to design the array, or if you would like to set array limits. If you have the computer design the array, you enter the lower and upper limits of the operating frequency band, following the screen prompts. The computer then goes to work designing the array. When the various element lengths and spacings are displayed, they will be in feet, but they can be converted to inches on keystroke command. After the element lengths and spacings are displayed, you then have the option of returning to the main menu or producing a hardcopy of the results.



The RAK Electronics/WB7RLX Antenna Design program is one of the few hamshack computational programs which include routines for the design and construction of multi-antennas, as exemplified by this Cushcraft DX-420 with phased collinear elements. The program described in the text provides routines relating to phasing, stacking, and spacing to aid in the planning of such antennas. (Photo courtesy Cushcraft Corp.)

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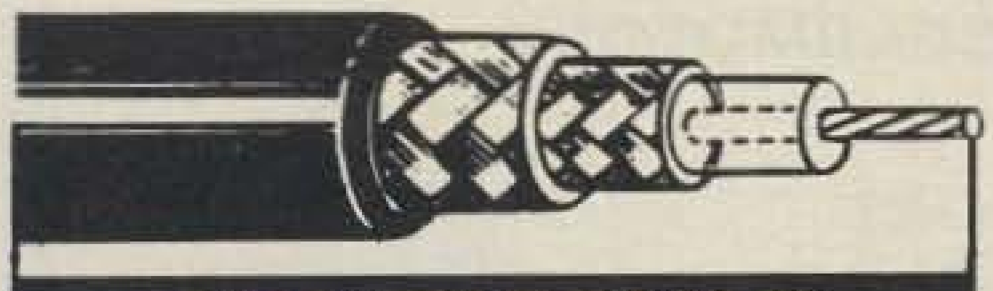

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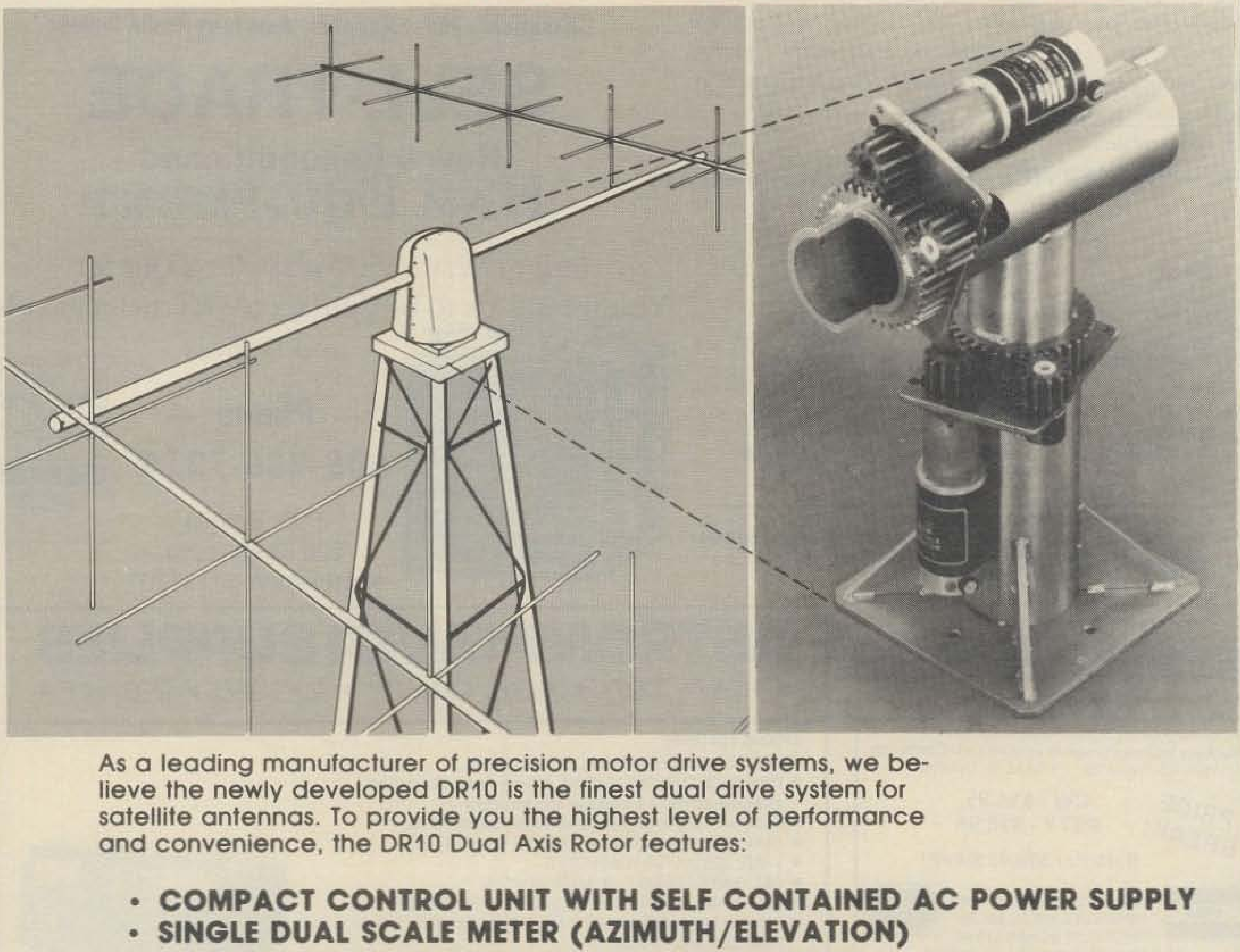

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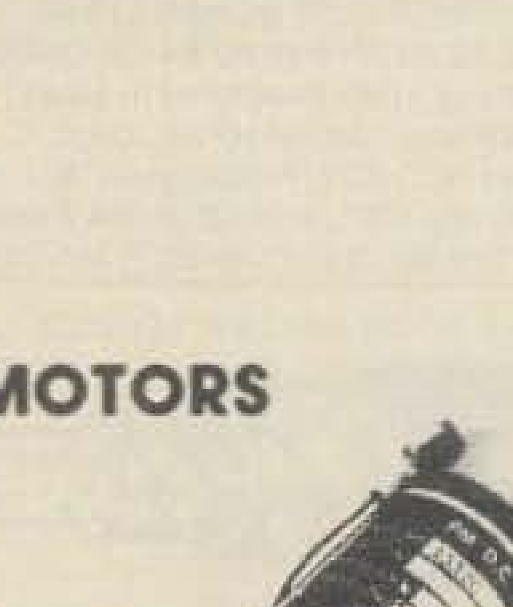

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```
                    4   ELEMENT   YAGI

           FREE SPACE WAVE LENGTH  69.541   FT.
           FREQUENCY   14.15 MHZ.
           ESTIMATED GAIN : 8.7 DB

ELEMENT                   LENGTH IN FT.          LENGTH IN WAVELENGTH

REFLECTOR                  35.304                          .508
DRIVEN ELEMENT             33.623                          .483
DIRECTOR # 1               31.85                           .458
DIRECTOR # 2               31.175                          .448

                          SPACEINGS

REFLECTOR TO DRIVEN        13.908                          .2
DRIVEN TO 1ST DIR.         11.127                          .16
DIR. 1 TO DIR. 2           12.517                          .18

BOOM LENGTH                38 FT.                          .546
ELEMENT DIAMETER           1.5 INCHES.                     .022
LENGTH DIAMETER RATIO   278.398116
```

Fig. 2– RAK Antenna Design Program printout.

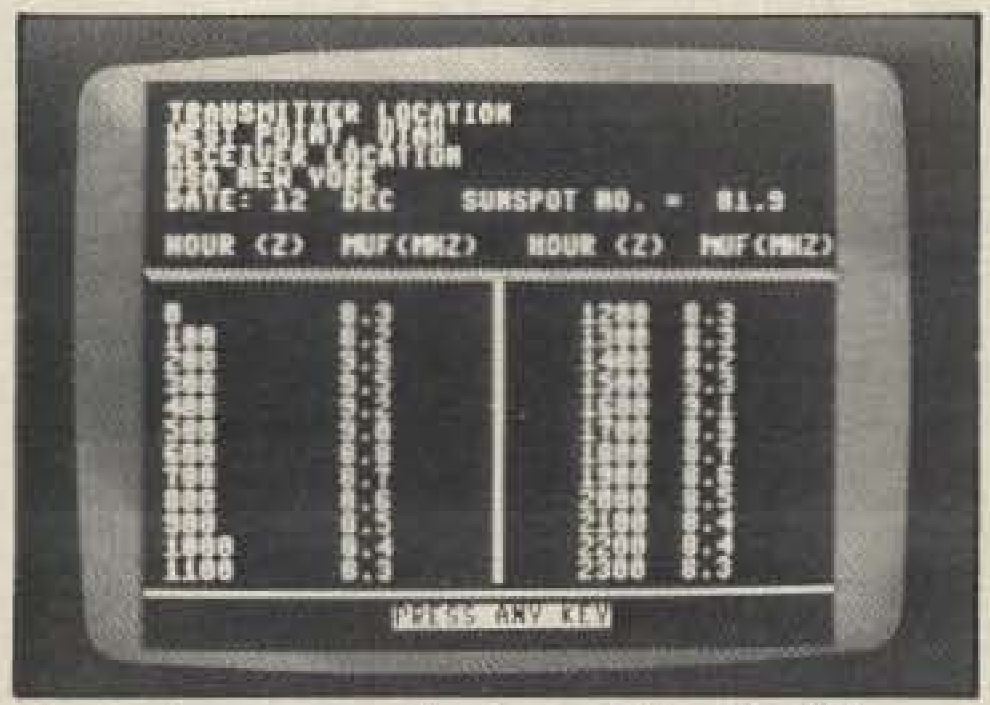
The "human design" Log Periodic choice is somewhat more complex, and you have to decide which limit you would like to set: boom length or the number of elements. You also need to enter some technical design parameters (**Tau** and **Sigma**); these factors are briefly explained on-screen, but reference to the *Antenna Book* is suggested. The Log Periodic routines were based on *Antenna Book* formulas, although some compromises were made by the program author to reduce an unwieldly number of program variables and, in the case of the Vic version, to keep the overall program within the limits of a 16K memory expander.

The WB7RLX program is certainly a good choice for the serious antenna experimenter, and it goes far beyond what most similarly priced programs offer. The program's cost is $9.95 on cassette, for either computer, from RAK Electronics. My only complaint regarding the program related to the almost total reliance on screen prompts; only a three-page instruction manual is provided with the program. However, WB7RLX advises that readers may obtain a copy of the expanded documentation, about 20 pages, directly from him for $3.00. His address: Eugene Morgan, WB7RLX, 1311 Cross St., Ogden, UT 84404.

A sample printout extracted from the Antenna Design program showing dimensions for constructing a 4-element Yagi for 20 meters is shown in fig. 2.

Another very nicely done WB7RLX program which is also distributed by RAK Electronics is the Prefix Locator and MUF Forecaster Program. This program, which is somewhat similar to the several programs we have examined in recent months to assist in beam heading and propagation path prediction, is designed to give the operator a quick and easy method of locating any prefix. After the prefix is located, you can enter the MUF (maximum usable frequency) portion of the program and determine the "best" frequency for communication. The program's flexibility allows prefix location by entering either the prefix, or the name of the city, state, or country (you'll see these different modes of prefix location in the main menu). After the prefix or country is located from the data statements contained in the program's built-in database, the computer will display the name of the country, prefix, antenna bearing, long-path antenna bearing, and distance in both miles and kilometers.

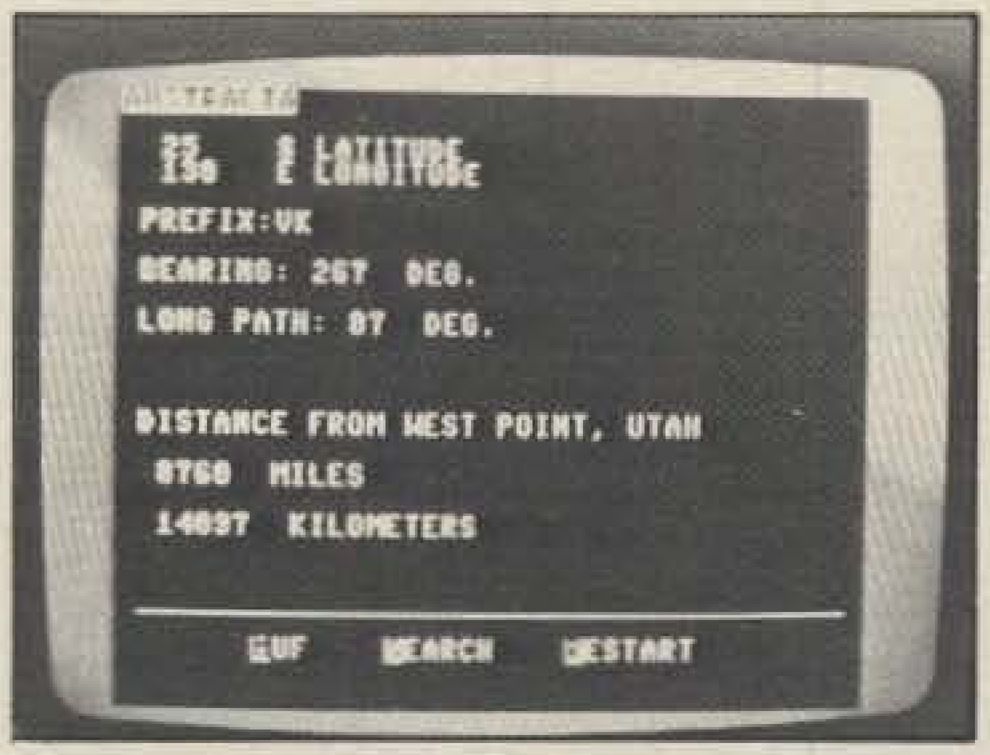
Looking at the on-screen prompts, after the information is displayed, you then see at the bottom of the screen: "MUF, SEARCH, RESTART." Selecting the MUF option takes you to the MUF portion of the program, where you are asked for the month, day, and solar flux. The computer will display a 24-hour MUF forecast for that day. The SEARCH mode works differently, depending on the original main menu selection. If you selected item #1 (Country or City), the search routine will look to see if the place you selected is listed under another prefix. If you selected item #2 (Prefix), the search routine will look for another country with the same prefix. And, if you selected item #3, the computer will look for countries within a certain search radius; you'll be asked to specify the size of the search radius.



```
TRANSMITTER LOCATION
WEST POINT, UTAH
RECEIVER LOCATION
USA NEW YORK
DATE: 12  DEC     SUNSPOT NO. =  81.9
HOUR (Z)  MUF(MHZ)   HOUR (Z)  MUF(MHZ)

PRESS ANY KEY
```

Typical screen display of the RAK Locator/MUF propagation program designed by WB7RLX. Program predicts MUF over a given path for a 24-hour period. Screen shown is from a Commodore 64, but Vic-20 versions are also available. An enhanced version of the program now sold has provisions for bar-chart screen display and printer output.



```
AUSTRALIA
33    S LATITUDE
130   E LONGITUDE
PREFIX:VK
BEARING: 267  DEG.
LONG PATH: 87  DEG.

DISTANCE FROM WEST POINT, UTAH
 8760  MILES
 14097  KILOMETERS

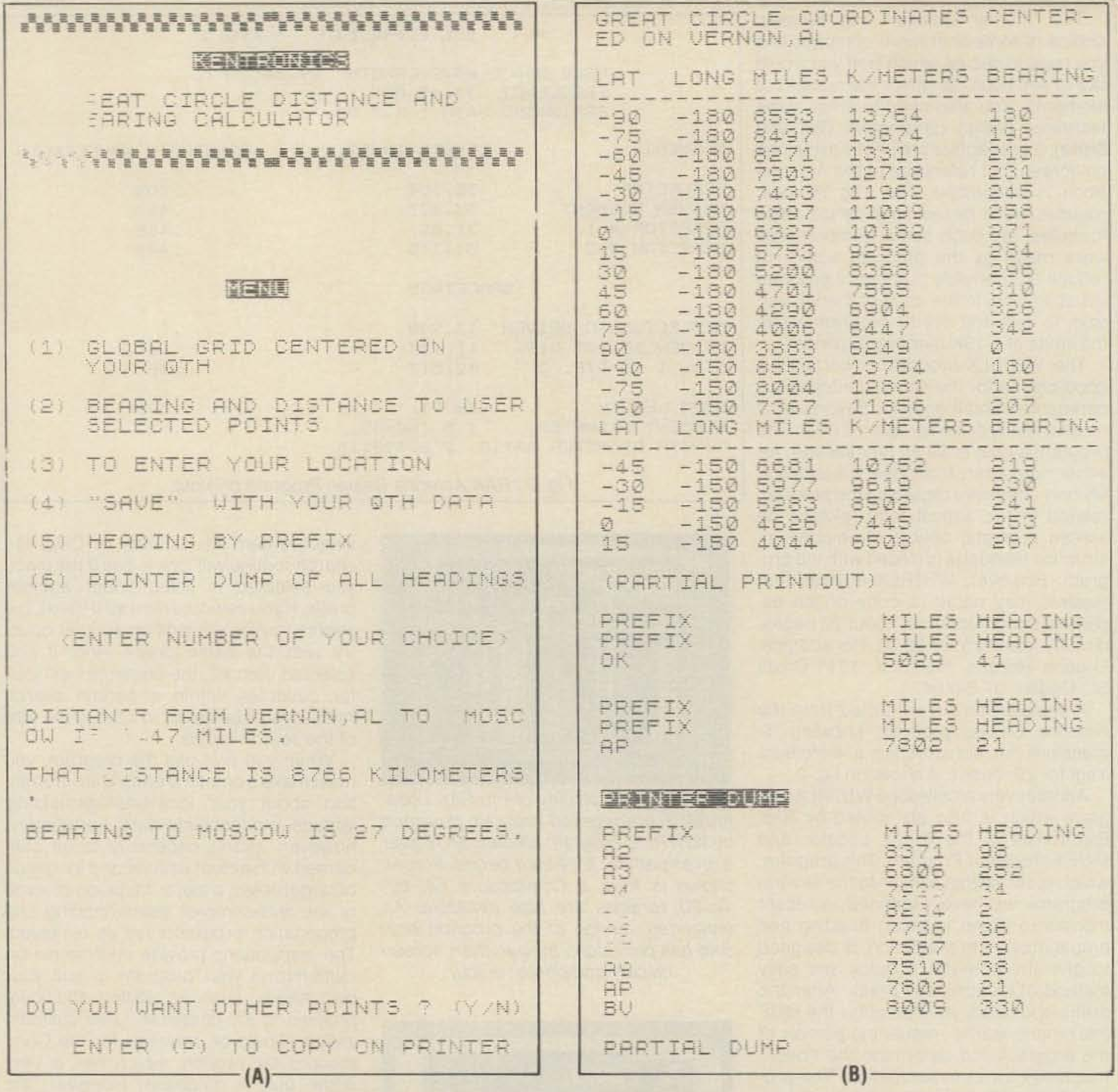
    MUF     SEARCH     RESTART
```

Locator/MUF program screen showing beam heading and distance outputs, with a starting point in Utah, to Australia. Note that both long- and short-path bearings are given. Built-in prefix database minimizes the need for manual entry of latitude/longitude; virtually all prefixes and countries are included in the 24K Vic and Commodore 64 versions. Programs now have a highly graphic print option not shown in this screen photo of an early version of the program.

When you first use the program, you must make a one-time entry with information about your locations—principally latitude and longitude data. Fortunately, however, it isn't necessary to be concerned with actual latitude and longitude of target areas, a major limitation of some of the less-complex beam-heading and propagation programs we've reviewed. The instructions provide information on customizing your program to suit your own needs, such as adding additional prefixes to the database. Little customization should be required for the Commodore 64 version, which has a very large, built-in database. However, the Vic's database is limited in the case of the 16K version. But the 28K version has virtually all of the prefixes and countries in the world, many of the large cities of the U.S. and world, and all of the states. The 28K version has enough free RAM to add many of your own listings.

The program documentation was well-written and adequate, although more extensive documentation to include some tutorial material on MUF prediction and analysis would be educational and useful. At the time we examined the program, no printer routines were included, although the author advises that he is working on updated versions that will have printer routines included in them.*

**As this column went to press, WB7RLX added several enhancements, including a highly graphic printout capability, to the program.*



```
               KENTRONICS

    EAT CIRCLE DISTANCE AND
    ARING CALCULATOR



                 MENU

(1) GLOBAL GRID CENTERED ON
    YOUR QTH

(2) BEARING AND DISTANCE TO USER
    SELECTED POINTS

(3) TO ENTER YOUR LOCATION

(4) "SAVE"  WITH YOUR QTH DATA

(5) HEADING BY PREFIX

(6) PRINTER DUMP OF ALL HEADINGS

  <ENTER NUMBER OF YOUR CHOICE>



DISTANCE FROM VERNON,AL TO  MOSC
OW IS [illegible]47 MILES.

THAT DISTANCE IS 8766 KILOMETERS
.

BEARING TO MOSCOW IS 27 DEGREES.




DO YOU WANT OTHER POINTS ? (Y/N)

   ENTER (P) TO COPY ON PRINTER
```

(A)

```
GREAT CIRCLE COORDINATES CENTER-
ED ON VERNON,AL

LAT   LONG MILES K/METERS BEARING
---------------------------------
-90   -180 8553  13764     180
-75   -180 8497  13674     198
-60   -180 8271  13311     215
-45   -180 7903  12718     231
-30   -180 7433  11962     245
-15   -180 6897  11099     258
0     -180 6327  10182     271
15    -180 5753  9258      284
30    -180 5200  8368      296
45    -180 4701  7565      310
60    -180 4290  6904      326
75    -180 4005  6447      342
90    -180 3883  6249      0
-90   -150 8553  13764     180
-75   -150 8004  12881     195
-60   -150 7367  11856     207
LAT   LONG MILES K/METERS BEARING
---------------------------------
-45   -150 6681  10752     219
-30   -150 5977  9619      230
-15   -150 5283  8502      241
0     -150 4626  7445      253
15    -150 4044  6508      267

(PARTIAL PRINTOUT)

PREFIX                 MILES HEADING
PREFIX                 MILES HEADING
OK                     5029  41

PREFIX                 MILES HEADING
PREFIX                 MILES HEADING
AP                     7802  21

PRINTER DUMP

PREFIX                 MILES HEADING
A2                     8371  98
A3                     6806  252
A4                     [illegible] 34
[illegible]            8234  2
[illegible]            7736  36
[illegible]            7567  39
A9                     7510  38
AP                     7802  21
BV                     8009  330

PARTIAL DUMP
```

(B)

Fig. 3– Kentronics Beam-Heading program dumps. (A) Printer "screen dump" from the on-screen display of the Kentronics Beam Heading program; note six available menu option selections. (B) Kentronics Beam Heading program partial printout of great circle coordinates centered on the user's QTH; below this is a partial printer dump of headings by prefix.

The Locator/MUF program is available on cassette tape for the Vic in basic and expanded versions for $9.95 and $12.95, respectively. For the Commodore 64, the program is priced at $12.95. Disk versions are available for an extra charge. Write to RAK Electronics, P.O. Box 1585, Orange Park, FL 32067. I should mention at this point that RAK has a wide selection of amateur-oriented programs for other computers, including the Pet, various Timex-Sinclair and Ataris, and the TI-99/4A.

The Forgotten Computer?

We've noticed little amateur-oriented software for the various Timex-Sinclair computers, although this will likely change as enhanced versions of the basic models—containing improved keyboards, color, and expanded memories—appear on the market. The early "bare" Timex and Sinclairs, now often available for $25 or $30 and sometimes even as promotional give-aways, hold promise, too, for "dedicated" or hard-wired applications, including computer control of automated satellite antenna positioning devices, and possibly transceiver control.

Ken Carpenter, KC4UG, has tried to correct the software availability problem as pertains to these computers. Ken recently sent me screen printouts and hardcopy samples of the several programs which he has prepared for the Timex/Sinclair computers. As with many such offerings, the programs developed as an outgrowth of programs which he wrote for his own use, there being few if any amateur-oriented programs available for his computer when he purchased it. He began with an antenna design program under the Kentronics name and ended up with about a dozen programs.

Ken's offerings included the original Timex/Sinclair Antenna Design program, Beam Heading, Logbook, Dupe Sheet, DXCC, Scanner Log, and Heading List. Recent offerings also include RTTY (Baudot and ASCII) and c.w. receive and transmit software and interface devices, which should also appeal to budget-oriented s.w.l.'s. All of the programs require a minimum of 16K memory. The Logbook program requires a printer, and one is also required to make use of all of the features of the other programs. Most work across the board with the ZX80, ZX81, TS1000, TS1500, and TS2040. There are some limitations with respect to the TS2000, particularly regarding the machine-language RTTY and c.w. software, however, so you should check with Ken for specific program compatibility with your system before purchase.

An interesting approach has been taken in the Beam Heading program, which calculates Great Circle bearings and distances. This novel program can plot a grid of the entire globe centered on the user's location. Entering a prefix causes the prefix, heading, and miles to that "point" to appear on the screen. Fig. 3 shows a sample "screen dumped" video display from the program, as well as a partial printout of prefix miles and headings. All of these products were provided to us on 4⅜ inch strip thermal paper.

While we don't own a Timex/Sinclair, and thus were not able to perform a "hands-on" review of Ken's programs, we know that he takes considerable pride in them, and to that end he included in the material sent to us copies of some very favorable user comments he has received. For more details, contact Kentronics, P.O. Box 586, Vernon, AL 35592.

Postscript: We note that the amateur software market is increasingly dominated by programs for the Vic-20, Commodore 64, Apple, and TRS-80, although in recent months we've noted a few ads for IBM PC software. For your convenience, we've rounded up some of these sources as we learn of them, and publish them in the column from time to time. Fig. 4 shows the latest update.

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Timex/Sinclair
Kentronics, Inc. (KC4UG)
P.O. Box 586
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P.O. Box 216
Brea, CA 92621

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M-P-Software
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Cumming, GA 30130

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Springfield, IL 62705

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Fig. 4–Amateur software sources update. This listing updates the listings which appeared in the October 1983 and January 1984 columns.

Wrap-Up

We've still more to say, but it will have to wait until next month. This month we've provided a mini-forum for reader comments, examined two software offerings from RAK Electronics, and highlighted Kentronics software for the Timex/Sinclair computers. Next time we'll "change gears" to present some antenna topics which we think you'll find quite interesting. See you then.

73, Karl, W8FX

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"HOW TO" FOR THE NEWCOMER TO AMATEUR RADIO

Facts For Prospective Novices—Part I of II

If you are interested in becoming an FCC licensed amateur radio operator, I urge you to read the introductory information in this article. Material is grouped under general headings for ease of use.

Licenses

There are presently five grades of amateur radio operator licenses; these are Novice, Technician, General, Advanced, and Extra class. There is no age or citizenship requirement related to obtaining any amateur license, nor does one have to hold a lower class license a specific length of time before making application to obtain a higher class license. As should be expected, additional frequencies and operating privileges are awarded as one upgrades from one class of license to the next. There is little to be gained by upgrading above the General class license, other than the satisfaction that is derived from upgrading in license class. Except for not being allowed to use relatively small segments of frequency at the low ends of code and voice segments of certain bands, the General class licensee can enjoy the full range of amateur operation.

All five types of amateur radio licenses are now issued for a ten-year maximum term. The amateur license is a two-in-one document. One part concerns the operator and the other part is about the station. The expiration date applicable to both parts of the license is normally ten years after the issue date. The operator portion of the license shows one's name, mailing address, signature, and class of operating privileges. The station portion of the license shows the FCC assigned callsign and the geographic location. Station licenses are not issued to post office boxes or other non-fixed points. Both operator and station data are printed on a single form, which happens to be FCC Form 660. Most amateurs keep their licenses with them so that they always have operating privileges no matter where they go.

Unlike some other radio station licenses, the amateur radio station license does not specify the equipment operators are permitted to use at a particular station. One can change equipment and/or accessories (antennas, etc.) at any time, and it does not involve changes to the station license. If two or more operators live together, they can use the same equipment, and each one identifies using their own callsign. One does not have to have any equipment to obtain a station license and callsign.

Eleven-year-old Kevin Thomson, KA7QLZ, helps make Layton, Utah easier to contact. He received his Novice license on his tenth birthday, 6 May 1983. His station includes a Yaesu FT-101 transceiver with matching external loudspeaker/telephone patch and v.f.o. units. He uses a Hy-Gain 10–40 meter vertical and an 80 meter dipole as his antenna system. Most of Kevin's operation is on the 15 and 40 meter bands. He shares the use of the station with his mother (Janet, KA7QMA) and his father (Jay, KC7MS). Kevin enjoys frequent contacts with his uncle (Craig, KA7MWH) and his grandfather (Bill, W7MZG), who both reside in Idaho.

Primary station licenses are issued to individual FCC licensed amateur radio operators, basically for their private use. However, guests are allowed. Secondary station licenses are issued to FCC licensed amateur operators, usually for use by several operators. Club stations and repeater stations are examples of secondary stations.

Bands

Novice licensees have four bands available for their use. The 10 and 15 meter Novice bands are 28.1–28.2 MHz and 21.1–21.2 MHz, respectively. Ten and 15 meters are most useful for long-distance (DX) communications during the day. Ten meter usefulness will continue to decline as the 11-year sunspot cycle low of 1987 is approached. The 40 and 80 meter Novice bands are 7100–7150 kHz and 3700–3750 kHz, respectively. The 40 and 80 meter bands provide optimum long-range communication opportunities during the night. Unfortunately, powerful international shortwave broadcast stations are spaced every 5 kHz throughout the 40 meter Novice band. When conditions are good to other regions of the world, American Novices are just about drowned out by broadcasts on 7105, 7110, 7115, 7120, 7125, 7130, 7135, 7140, and 7145 kHz. Despite its many drawbacks, the 40 meter Novice band draws more new amateurs than any other Novice band. The 80 meter Novice band has much less interference than the 40 meter Novice band, but it is less popular than 40 meters because an 80 meter antenna is large. A half-wave dipole cut to be resonant at 3725 kHz is 125 feet 8 inches long. Despite the problems related to erecting an 80 meter antenna, it is advisable to use this band.

The 10 and 15 meter bands should be used during the day, and one should switch to the 40 and 80 meter bands at night. It is advisable to operate on 10 meters whenever it is open (useful) during the day. When 10 meters dies (no signals), shift to 15 meters and use it until it dies during the early evening. When the daytime 10 and 15 meter bands are no longer good for long-range contacts, it is advisable to shift to the 40 or 80 meter band. If 40 meters is too crowded and/or shortwave broadcast interference is too strong, shift to 80 meters. The 40 and 80 meter bands remain good throughout the night.

When 10 and 15 meters become least useful for long-distance communications in 1987, 40 and 80 meters will provide optimum long-range communication opportunities. One can contact amateurs at the other side of the world on every Novice band at some point in the 11-year sunspot cycle.

Each Novice band is close to the center of the associated amateur band. The entire 80 meter band is 3500–4000 kHz, whereas the 80 meter Novice band is 3700–3750 kHz. Similarly, the 40, 15, and 10 meter bands are 7000–7300, 21,000–21,450, and 28,000–29,700 kHz, respectively. The Novice 40, 15, and 10 meter bands are 7100–7150, 21,100–21,200, and 28,100–28,200 kHz, respectively.

Novice bands are really subbands within the regular amateur bands. The Novice subbands are not the exclusive domain of Novices. A more correct term for these bands is the Novice, Technician, General, Advance, and Extra class subbands. If Novice subbands were re-

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stricted to Novice-only use, the Novice licensees would have more exclusive frequency spectrum than the Extra class licensees.

Modes

Novices are only allowed to operate carrier on-off radiotelegraphy, which is also called code. It is designated as A-1 in the FCC Part 97 Amateur Radio Service Rules and Regulations. Amateurs commonly refer to code as c.w., which is technically incorrect. Radiotelegraph communications are more efficient than any other mode of communication. The code signal is packed into a very narrow bandwidth, providing excellent long-range communication capability. The narrow code signal also allows one to use maximum selectivity during reception, which minimizes interference from other stations. It is advisable to develop good code sending and receiving capability, and on-the-air operating is the best way to do this. If your station is located in a crowded home, code operation is preferable to voice operation, and it is less susceptible to interference from other people in the house.

My students usually leave code almost entirely when they upgrade to the General license. Later on, most of them settle down to a comfortable mixture of code and voice operation. It is good to try all bands and all modes of communication. You may find that you particularly enjoy operating radioteletype, slow-scan television, frequency modulation, television, amplitude modulation, single sideband, narrow-band frequency modulation, double sideband/suppressed carrier, narrow-band voice modulation, or some other type of emission. Try everything, but first develop good code capability.

Restricting Novices to radiotelegraph operation provides a useful introduction to the most efficient communication mode. Code equipment is the simplest and least expensive amateur gear, which also benefits the new amateur.

Power

The maximum output power any class of amateur licensee is allowed to use in any Novice band is 200 watts peak envelope power (PEP). This is more than enough power to work other amateurs located throughout our country and around the world. I use 20 to 40 watts and work the world with that amount of power. Note that Technician, General, Advanced, and Extra Class amateurs are limited to 200 watts PEP output when operating in the Novice bands.

High power is not the key to good results. A good antenna system and a good radio frequency ground system are more important than power. Increased power results in increased possibility of interference to other amateurs, your neighbors, and your home entertainment electronic equipment.

John Hooker, KA7SIU, of Prescott, Arizona, first became interested in amateur radio in 1959, but the code was not mastered at that time and the high cost of equipment dampened his enthusiasm. He obtained a Globe Chief 90 transmitter during a 1983 swapmeet and received his Novice ticket in March 1984, thanks to help from the Prescott Amateur Radio Association. John has a Hallicrafters S-38 receiver and a dipole antenna for use with his Globe Chief. He is certified as a CD shelter manager and is training himself to be a radiation monitor. Listen for him on 15 and 40 meters.

International Considerations

Radio waves know no boundaries. When my son Richard went on the air as a Novice, his first contact as KN1SAR was with an Italian amateur. When you get on the air, you are very likely to contact foreign amateurs in many parts of the world. There is presently no restriction against contacting amateurs in any country, and some of these foreign (DX) amateurs regularly operate in the American Novice bands to provide new amateurs with DX contacts and QSL (confirmation) cards.

The International Telecommunications Union (ITU) oversees standardization of worldwide communications procedures and practices. One of the many groups that provides input to the ITU is the International Amateur Radio Union (IARU), which helps standardize worldwide amateur radio procedures and practices. The American organization that represents us in the IARU is the American Radio Relay League (ARRL). The ARRL does many things to help promote amateur radio at local, regional, national, and international levels. I am an ARRL charter life member, and I urge all amateurs to become members.

Our country has third-party traffic agreements with several other countries. These agreements allow amateurs in these countries to exchange non-commercial (non-business) message traffic to and/or from other people in their countries. One cannot accept payment in any form for performing this service. Most of these U.S.A. third-party agreements are with other ITU Region II countries. Region II is North, Central, and South Americas. Region I is Europe and Africa.

ITU Region III is Australasia and the rest of the Southern Hemisphere. Novices are allowed to handle third-party traffic.

Our country also has reciprocal operating agreements with several countries. These agreements enable amateurs to operate in each other's countries without having to be examined again. Each pair of countries recognizes and accepts each other's licensing of amateur operators. As an example, if my wife were operating from Ontario, Canada (where the amateur radio callsign prefix is VE3), she would identify as W6JEP/VE3.

Very few countries have an entry-level ticket similar to our Novice license. Consequently, most reciprocal agreements do not cover American Novices. However, this is a useful feature for upgraded American amateurs visting or temporarily living in any country with which we have a reciprocal licensing agreement.

Interests

Amateur radio is very flexible. It has things to offer everyone. No one is too young or old to be an amateur. Men and women, boys and girls, rich and poor, famous and obscure, plus the hale and handicapped people all are equal on the air.

It is wise to try as many bands (frequency segments) and modes of communications as possible. You may develop an interest in operating a mode that you had not thought you would like to use. Modern radioteletype (RTTY) equipment is typical of relatively inexpensive but fascinating gear. Slow-scan TV (SSTV) and regular (fast scan) amateur TV (ATV) attract more amateurs all the time. The various voice modes have their own supporters; these include AM (amplitude modulation), FM (frequency modulation), NBFM (narrow band FM), SSB (single sideband), DSD (double sideband, suppressed carrier), and NBVM (narrowband voice modulation). The Novice has to upgrade before she/he is allowed to use any communication mode other than code; these other modes provide good reasons to upgrade one's class of license.

Most amateurs exchange QSL cards to confirm their two-way radio contacts. These cards provide proof of such contacts, and they are often used in applying for the hundreds of operating awards that are available to amateurs. It is advisable to get 500 to 1000 QSL cards as soon as one's callsign is known. The best way to receive cards is to send them, and you need to have an adequate supply of QSLs if you intend to be active on the air. Purchasing small quantities of QSL cards is expensive. I am administrator for the Ten American Districts (TAD) award that is sponsored by an amateur radio club. This is a typical beginner's award. It requires proof of contact with an amateur in each of the ten American callsign districts. Anyone interested in obtaining TAD award details can send to me a self-addressed, stamped envelope with a request for a TAD data sheet.

Novices can earn many of the operating awards. When one upgrades to a higher class of license, the QSLs received as a Novice still apply towards operating awards; all one has to do is obtain the remaining required QSLs to get various awards.

Traffic handling is a popular operating activity. There are several slow-speed traffic nets that operate in Novice bands to attract Novices. The training is good, and this is a great way to increase code proficiency while helping those who submit and receive the messages you handle.

Chatting is the most popular operating activity, and it is called ragchewing. The ARRL issues a special award (RCC) to ragchewers. It is interesting to learn about the amateurs one contacts on the air, and friendships develop with amateurs who are contacted several times. When someone contacts a foreign (DX) amateur from our home, we usually locate the country/island in our atlas and read about it in our encyclopedia. This is an added interest for amateurs. One's knowledge of history and geography is increased as one contacts DX operators.

Amateur radio causes one to develop more appreciation and knowledge of languages, mathematics, physics, science, monies, postage stamps, time zones, and other factors.

If you are interested in social aspects of amateur radio, you can attend flea markets, amateur radio club activities, and amateur radio conventions. Conventions usually offer the best social opportunities, but some provide excellent (and more frequent) social activities than typical annual conventions.

First Part Conclusion

This completes the first part of this two-part article. The second part covers callsigns, licensing, examination, equipment, antennas/accessories, and costs.

73, Bill, W6DDB

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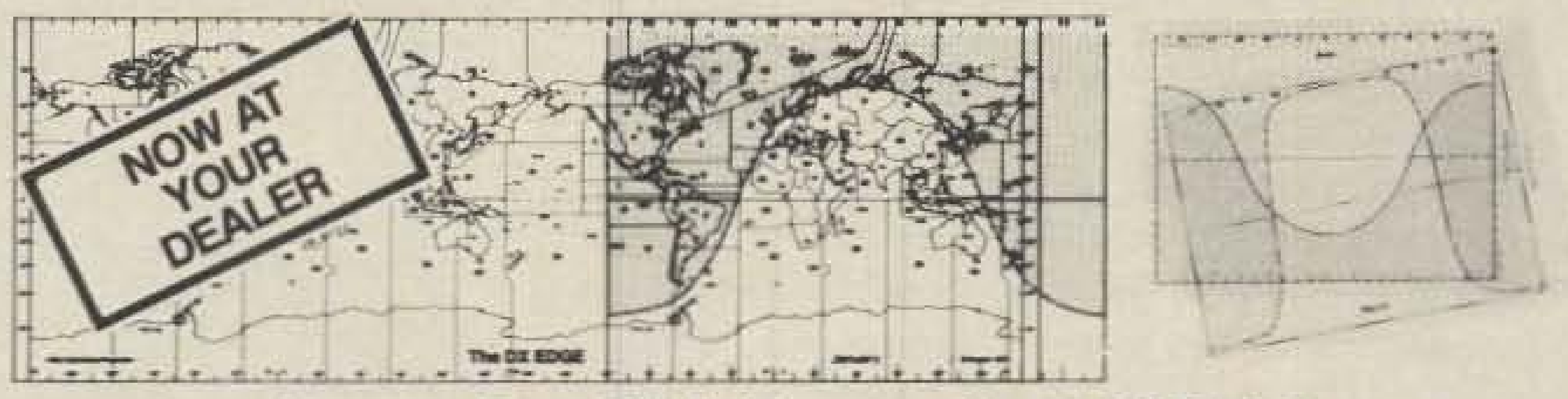

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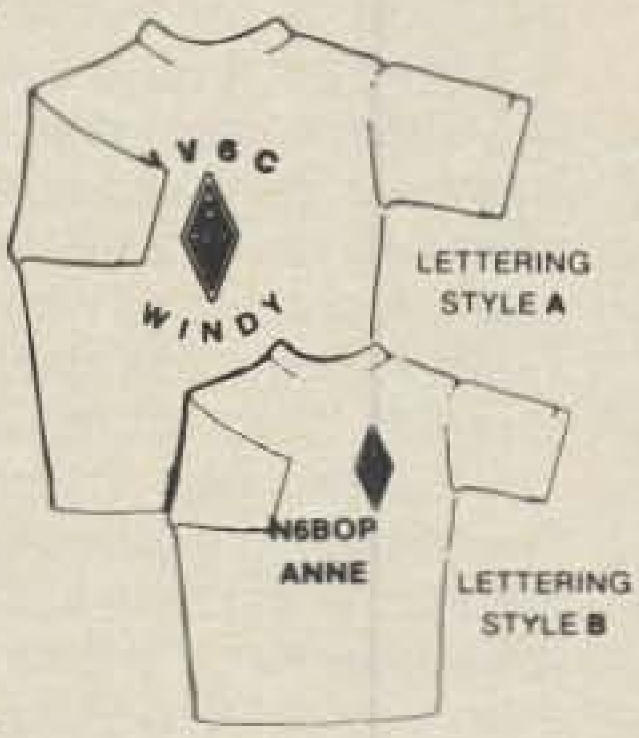

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DX

a monthly feature by

HUGH CASSIDY, WA6AUD

NEWS OF COMMUNICATIONS AROUND THE WORLD

When I remember bygone days,
I think of how evening follows morn;
So many I need were not yet dead,
So many I have were not yet born . . . .

It was a warm, mid-summer August morning, and the Old Timer had come down the hill to sit with us under an oak tree and watch the tankers move up the bay and under the bridge to the refineries. We talked of little things, none of which were important, but little things that the Old Timers like to talk about. Then one of the Newcomers came bouncing up the hill, and we now wonder if we will ever again regard things the same.

"Tell me what you think of the Mystique of DXing," he said. "Certainly with all your DXing over the years you must have had some experience in encountering the Ultimate Reality of DXing, right?"

We heard the Old Timer clear his throat, the sound deep in his chest, and we knew he was watching us out of the corner of his eye. We knew he was waiting to see if we would jump in on this one. However, as every DXer knows, Old Timers have the knowledge and insight on just about everything that has ever happened in DXing, and we had no intention of getting in his way on this one. Finally, the Old Timer had to speak, for certainly the Newcomer was waiting expectantly.

"The Mystique of DXing at times appears to be unrecognized by a large number of DXers," the Old Timer started in, "yet often there is heard mention of the 'Eternal Enigmas' of DXing, or possibly even the 'Mysteries of the Ages.' Some think that these terms are used to avoid a direct answer; some use the terms without really understanding what they are saying. But there is a mystique which takes time and experience to recognize and understand. But then when one understands it is no longer a mystery. Perhaps one understands but cannot explain, and often when it is explained a newer DXer might not understand." The Old Timer was holding the attention of the Newcomer, his eyes fastened on him. "You understand so far, don't you?" he asked, and the Newcomer blinked.

"Not exactly—yet," he replied. "I was wondering if you might explain some of the mystery around the rituals of DXing, and perhaps even something about the experience of DX ecstasy and the mystical transport to a higher level of DX awareness. Things that might be done, or have been done, to induce DX exaltations, and those DX traditions and incantations which bring a DXer to the threshold of overwhelming rapture. Certainly as a DXer you have had experience with all of this, haven't you?"

Some of the BY stations were reported inactive late last spring, but BY4AA was still being reported. Here is Xuru, the operator often heard at BY4AA. Often a YL operator is heard; this is Miss Chen who speaks English well. (Photo via W9WHM)

Show above is Al, J73D, at his Dominica Island operating position, from where he has given many DXers a new one. At home up north, he is known as W2BP. QSL's go to Arnie, W2OB. (Photo via W2LZX)

At this point we did not know how the Old Timer might reply, but for sure we knew we had wandered into a woods where we were lost. We hoped that things might improve, and we waited for the Old Timer to reply. He finally did, but all he said was "Such as what?"

The Newcomer shrugged his shoulders. "I was hoping that you would take it from there," he said. "I hoped to learn from your experience in such things. Perhaps even a discussion of the magical formula expressed in 'CQ DX.' Some have indicated, and I tend to agree with them, that the incantation 'CQ DX' has deep and strong meanings not easily noted by those not familiar with DXing. You have to but listen on the amateur bands, and you will hear the chanting, especially during contests. It does seem that the chant brings exaltation, perhaps even more so when the chant is answered. It does not take much study to detect the ritual aspects of the chanting, the repetition of the magical formula, and even the obviously special techniques of breathing which allow a seemingly endless calling of 'CQ DX' without ever having to pause to draw another breath. It has been noted in some studies that those who call 'CQ DX' are able to reach such an exalted state that they need not even bother to listen for replies. It has been said that perhaps these are the true aesthetics of DXing, possibly attaining a state of transmigration to the understanding of the Noble Truths of DXing. Others have disagreed with this premise, saying that they are transported to the chaotic state of QRM. But both do believe that they are transported. 'CQ DX' by itself is but four letters of the alphabet to the uninitiated. 'CQ DX' to a DXer has a vast possibility of meanings."

We were not sure ourselves whether or not the Old Timer was understanding all of this, but he certainly wasn't going to give any explanations—yet. "You mean to tell me," he asked the Newcomer, "that when someone is in a DX contest calling 'CQ DX,' you think it is a mystic incantation and that they are experiencing an exaltation beyond DXing?"

The Newcomer was hardly daunted by the challenging tone of the Old Timer's voice. "Of course," he replied. "How else can one explain the calling of 'CQ DX'? At times it does seem that DXers, or at least some of them, do attain the level of Supreme Intuition."

After a bit we realized that we were totally lost on this one. The conversation between the Old Timer and the Newcomer continued, but without us. We dimly heard references to ". . . the affinities for mystical DXing," the ". . . need for a working philosophy for DX," and things that we did not understand at all. We closed our ears and contemplated the ship traffic on the bay and the far mountains. We noted that a haze had started to rise, and the visibility was not as good as it had been.

Later, after the Newcomer had left, we asked the Old Timer what the decision was. He laughed. It was a relief just to know that he could still manage that.

"As we get along in years," he said, "we still find that DXers are the thinkers that they have always been. But sometimes I find that instead of DX, they come up with questions that they may think relevant, but that at times are confusing. I find that DXers are asking questions that

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1102	KI3L		

S.S.B.

1655	WB0GOO	1658	I3ZSX
1656	VE7EOA	1659	VE4AT
1657	IN3AHO	1660	CP8HD

C.W.

2258	DK3QE	2262	HL4XM
2259	IS0FPH	2263	JK1DVX
2260	KA0GZS	2264	IS0MVE
2261	K6OMB		

VPX

900	KDX1A

WPNX

219	KB4HRP

Endorsements

Mixed:	450 K1HDO, KI3L, AI8S. 500 K8HDO, KI3L, AI8S. 550 K1HDO, KI3L, AI8S. 600 K1HDO, KI3L, AI8S. 650 K1HDO, KI3L, AI8S. 700 K1HDO, KI3L, AI8S. 750 AI8S, DK5AD. 800 K2POF, AI8S, VE5XK, DK5AD. 850 DK5AD. 900 DK5AK. 950 YU2CBK, DK5AD. 1000 YU2CBK, DK5AD. 1050 DK5AD. 1100 DK5AD. 1150 DK5AD. 1250 N6JM. 1350 W4BQY. 1500 K9BG. 2350 W2NC.
S.S.B.:	350 IN3AHO, I3ZSX, JM1IFB, CP8HD, DK5AD. 400 IN3AHO, I3ZSX, CP8HD, DK5AD, WI4K. 450 IN3AHO, I3ZSX, NB5C, CP8HD, DK5AD, WI4K. 500 NM5Y, IN3AHO, W7KWI, CP8HD, DK5AD, G4GED, WI4K. 550 WI4K, IN3AHO, DK5AD. 600 IN3AHO, VE5XK, DK5AD. 650 IN3AHO, VE5XK, DK5AD, K8ZZU. 700 IN3AHO, DK5AD. 750 IN3AHO, DK5AD. 800 DK5AD. 850 DK5AD, ZL1AGO. 900 KZ2P, DK5AD. 950 DK5AD. 1000 DK5AD. 1050 DK5AD. 1100 W2NC, DK5AD. 1150 DK5AD. 1200 DK5AD. 1300 I6ZJC. 1350 I6ZJC. 1400 I6ZJC. 1450 I6ZJC. 1650 W0YDB.
C.W.:	350 IS0FPH, K6OMB, PY2VW, DK5AD, IS0MVE. 400 IS0FPH, K6OMB, YU4ELI, DK5AD, IS0MVE. 450 IS0FPH, KW9N, DK5AD, IS0MVE. 500 IS0FPH, D32CT, DK5AD, IS0MVE. 550 IS0FPH, DK5AD, IS0MVE. 600 IS0FPH, W0JIE, DK5AD, IS0MVE. 650 IS0FPH, K2POF, DK5AD, IS0VE, SM5DAC. 700 SP1ADM, IS0FPH, DK5AD, JA5SIX. 750 SP1ADM, IS0FPH, DL5AD. 800 IS0FPH, DK5AD. 850 IS0FPH, K9UQN, W9VEN, HA8UB, DK5AD. 900 IS0FPH, DK5AD. 950 IS0FPH, DK5AD. 1000 DK5AD. 1450 VE7CNE. 1550 N2AC. 1650 G2GM.

10 meters:	4X4FU, VE7EOA, WN5MBS, IN3AHO, DK5AD.
15 meters:	VE1YX, DK5AD, 4X4FU.
20 meters:	KW9N, WN5MBS, IN3AHO, VE1YX, 4X4FU.
40 meters:	4X4FU.
80 meters:	K8LJG, 4X4FU.
160 meters:	SP1ADM.

Asia:	K2POF, IN3AHO, JA6GWU, JM1IFB.
Africa:	DK5AD.
No. America:	SM5DAC, WN5MBS, JA6GWU, WI4K.
So. America:	SP1ADM, WO4L.
Europe:	WN5MBS, IN3AHO, JA6GWU.
Oceania:	JA6GWU, DK5AD.

Award of Excellence: VE7IG

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage if air-mail desired) to CQ WPX Awards, P.O. Box 1351, Torrance, CA 90505-0351 U.S.A.

There have been instances in which DXers have traveled hundreds of miles just to see what a DX bulletin editor looks like. We save the travel. Here is Harvey McCoy, long-time publisher of the Long Island DX Bulletin. Harvey was at the California International DX meeting this past spring.

Who targets the DX tips for Big Guns and Little Pistols? It's Bob Winn, W5KNE, Editor and Publisher of QRZ DX. Bob was at the big California DX meeting a few months back hiding anonymously behind those badges.

were not heard years back. Or maybe it's just that I didn't hear them. But now they ask these questions, and maybe someday I will have answers to all of them."

We were well aware that DXers are always thinking, sometimes even along lines that we hesitate to follow. But one should always be willing to learn just a bit more, and we asked the Old Timer, "What about this Mystique of DX? Have we missed something along the way?"

The Old Timer shook his head. "You didn't," he said, "and no true-blue DXer ever really misses it. DXers come seeking and they find it. They may think they are only looking for countries and the DXCC, but they acquire something else along the way that they usually were not even aware exists."

"Such as what?" we said. "Give us an example."

There was that patient look on the face of the Old Timer that always comes when he has to explain what he believes is the obvious. "You were at the big International DX Meeting this spring," he said, and we said we had been. "And as usual there were DXers from all over the world at the meeting, right?" he continued, and we nodded our heads. "And when there were seminars on DX matters, or on antennas or contests or DXpeditions, did everyone understand what was going on? In the discussions did they understand the points being raised even though some at best were obscure? Everyone there was showing universal awareness of what was being discussed, right?"

"Of course," we answered. There had been DXers from Finland and India, from Switzerland and Colombia, from Canada and Japan, from South Africa and Hawaii, from Alaska and Australia. But there are always DXers from all over the world at these DX conventions. That's the way it has always been. And every DXer there spoke in a language understood by everyone else present—pure DXese, the universal tongue!

"Maybe you even heard someone along the way say, '. . . no DXer ever comes as a stranger,'' and we had to admit that we had heard that said. We even remembered a visitor from Saudi Arabia who recently showed on the local scene, a stranger in town, but someone who had gone to the DX club meeting with Lloyd and Irvis Colvin, who had lured Old Sam down off the mountain the following day for a visit and admonitions on getting 80 meter c.w. on the air from HZ-land, and

The WAZ Program

10 Meter Phone

276	XE1OX	277	JK1XEL

15 Meter Phone

196	K2EY	198	XE1OX
197	N7ABJ	199	JA9MQ

20 Meter Phone

497	W8VSA

40 Meter Phone

26	XE1OX

80 Meter Phone

25	XE1OX

10 Meter C.W.

52	W8RSW

15 Meter C.W.

108	N4KG	109	JR6UDM

20 Meter C.W.

213	SP2BRZ	214	W8CD

40 Meter C.W.

48	JA1RWI	49	W8RSW

All Band WAZ

S.S.B.

2838	EA4BVE	2846	KD6M
2839	JG1GWL	2847	W4YKH
2840	VE3GPP	2848	K6PKO
2841	ZS6ABA	2849	IK0AZG
2842	HA0DU	2850	WD6EKR/QRP
2843	IN3AHO	2851	WA2KLI
2844	K6ZOR	2852	ON7DR
2845	W2EKO	2853	PA0MOD

C.W. and Phone

5748	SP6FER	5757	KD9M
5749	OK1JIM	5758	HB9CND
5750	NO4J	5759	JF3AUA
5751	KF6A	5760	OK3CFF
5752	N9ALC	5761	N9ANR
5753	ZS6BCR	5762	LZ2RS
5754	I5JRR	5763	WA2VYA
5755	W9HAH	5764	KI6O
5756	JK1DVX		

Applications and reprints of the latest rules may be obtained by sending a self addressed stamped envelope (37 cents) size 4½ × 9½ to the W A Z Manager, Leo Haijsman, W4KA, 1044 S.E. 43 Street, Cape Coral, Florida 33904. Applicants forwarding QSL cards either direct to the WAZ manager or to a check point should include sufficient postage for safe return of their QSL cards. The processing fee for all C.Q. awards is $4.00 for subscribers and $10 for non-subscribers. In order to qualify for the subscriber rate, please enclose your latest CQ mailing label with your application.

who eventually had headed out after touching bases with a lot of the locals. But that was hardly anything new, and we told the Old Timer so.

"No one said that it was," the Old Timer retorted. "It was mentioned just to give some inkling that there are a lot of things that DXers may take for granted, but which on closer analysis indicate something a bit more significant. It is even possible that at times you may have noted that a DX mystique does exist, but possibly you thought it to be just a natural part of the action. Only when one stops and thinks about it does the mystique evolve into something definitely there but often unsuspected, right?"

Of course the Old Timer was right. We just had not stopped to think about it. For a moment we thought of asking some questions about the Newcomer and his various states of exaltation, but then we decided we had heard enough about it for this day at least. But we still had to ask, "Then there really is something to what the Newcomer was rattling on about—that there are DX rituals and incantations and things like that. Are there?" If we thought we would get a quick answer, we were wrong. Later we realized that we had hardly gotten an answer at all.

"There has always been the Mystique of DXing," the Old Timer said, "and many think that it is a definite part of the DX scene. But if one strays towards more analysis and less operating, the result often is that something is lost. Just believe that it is there and enjoy it. Most DXers do. And you know what to do if there is something that you don't fully understand, don't you?"

Here is a true-blue Argentine Old Time DXer, LU1SH. Some say that the 'S' in the suffix is not often found. This is Fermin Anzalaz, who also holds the calls of LU6BBL in Buenos Aires, LU7HSB in Cordoba, and LU1SH in downtown La Rioja. Fermin works a lot of c.w., 10 kHz above the bottom edge on 40–10 meters, 14180/14250 kHz on 15 s.s.b.

We had been led around until we were again where had often been in the past with questions aimed at the Old Timer. "You mean, 'Believe!' we said, and the Old Timer nodded.

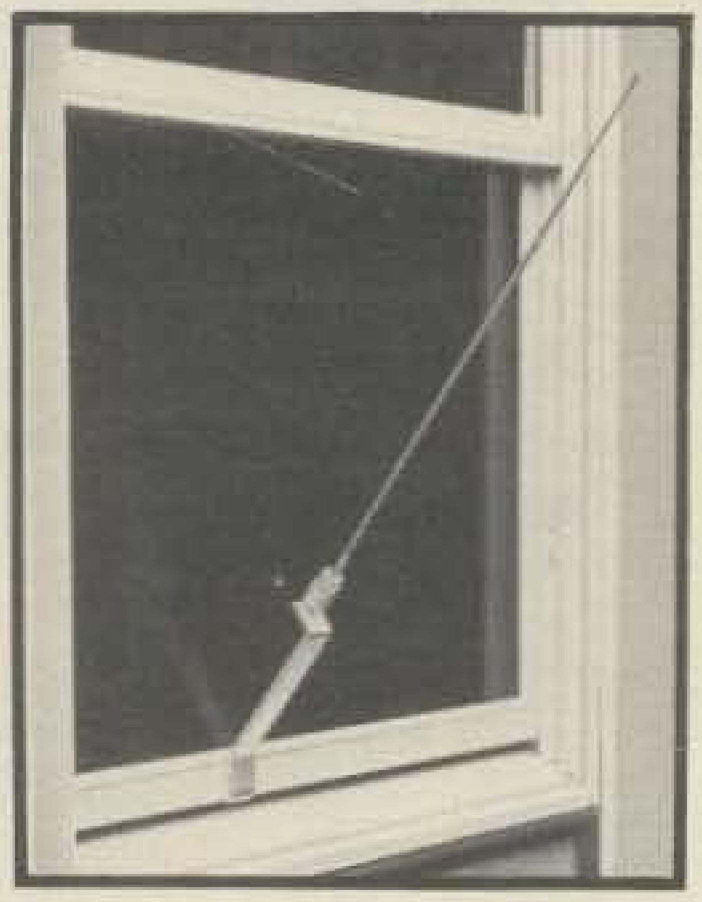
So we believe. DXers always should believe and most do. At this point perhaps we do not understand all of the nuances of the Mystique of DXing, but we are believers, and always more so when there is the possibility of a new country. All true-blue DXers are true-blue Believers.

Arkansas DX Meeting

Usually held in December, this year the Arkansas DX Association will meet the first weekend in October. The last couple of years they have encountered miserable weather, and they figure that a change might improve things.

The DXers will gather at the Majestic Hotel in downtown Hot Springs, Arkansas. Plans are for things to start on Saturday afternoon, October 6th, with the big DX banquet on Saturday evening. Speakers will include a number of active and prominent DXers. Earl Smith, KD5ZM, is handling any requests for information as well as the reservations. You can find KD5ZM at Rt. 10-7 Meadow Cove, Pine Bluff, AR 71602. There is also an information ADXA net at 3815 kHz at 9 p.m. CDST Sunday evening or 0200Z Mondays.

New officers for the year are Andy Toth, W5LQN, President; Walt Cuga, W5ACE, Vice-President; and the busy Earl Smith, KD5ZM, Secretary-Treasurer and convention catch-all. Maybe you won't remember all of this, but remember that what used to be in December



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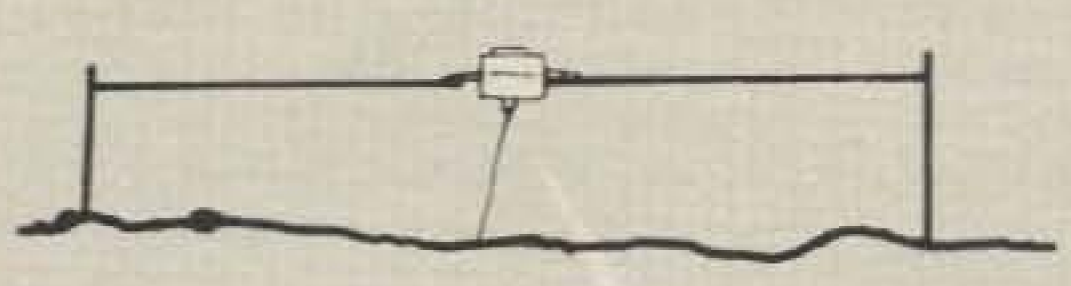

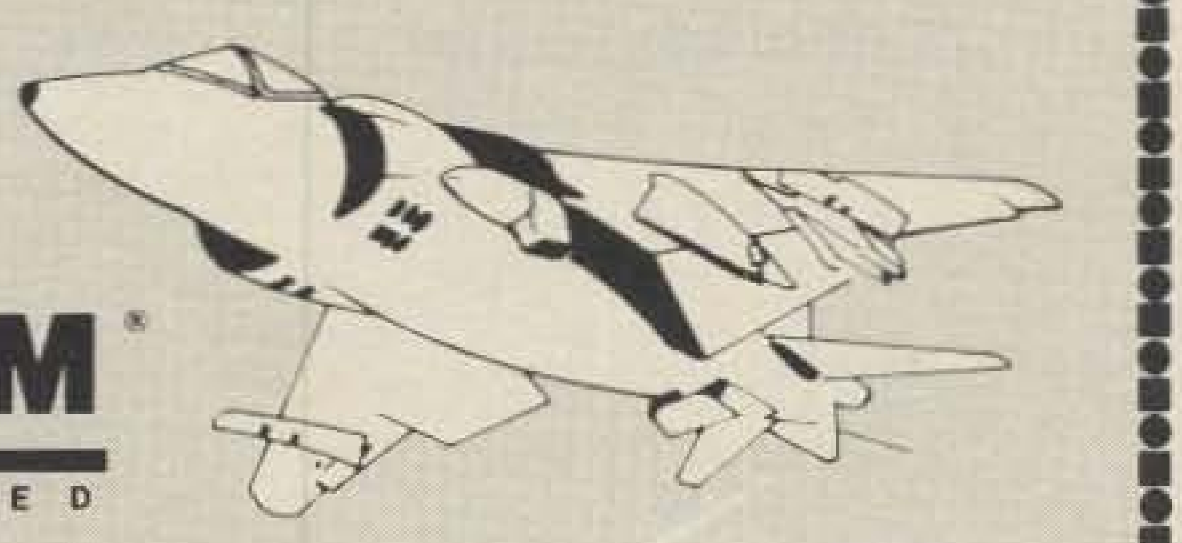

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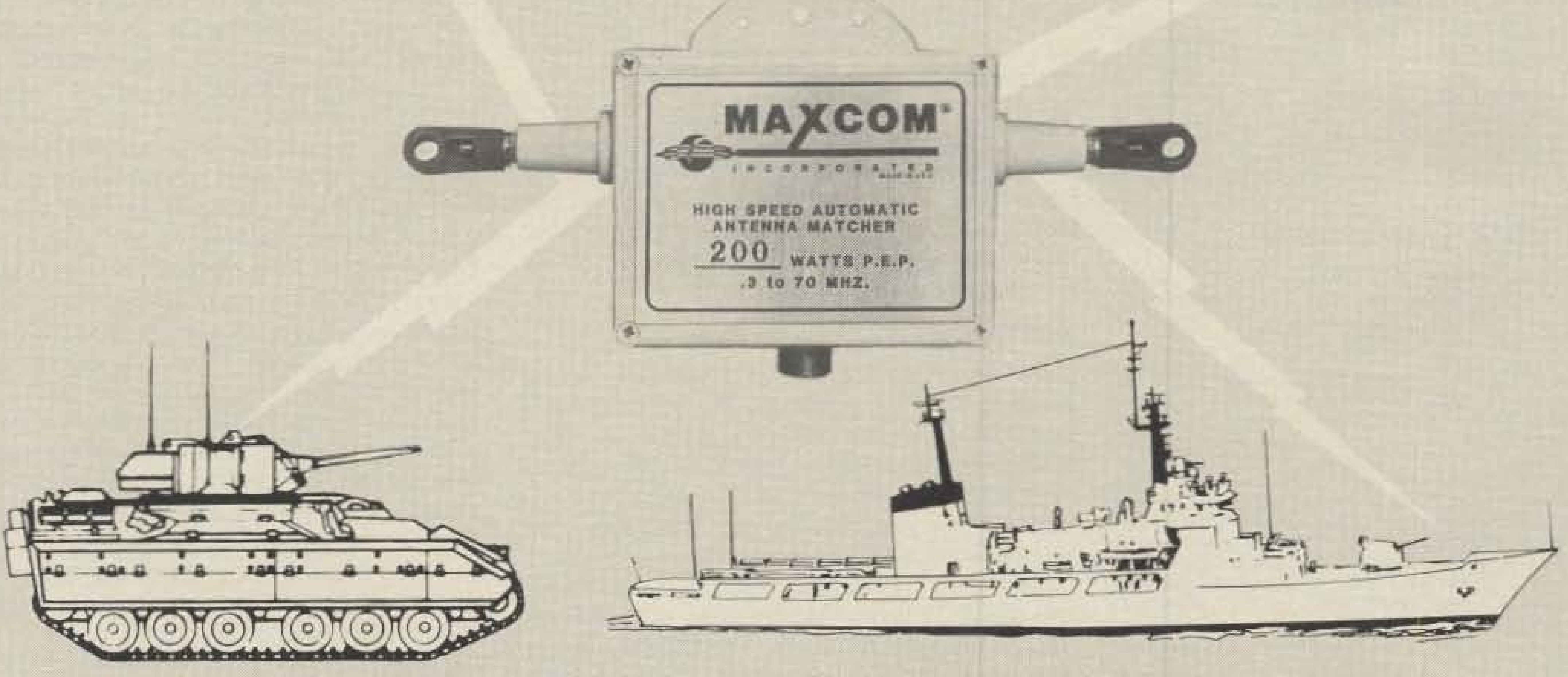
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1332	VE3BGX	1335	EA2IA
1333	JH1LZC		

C.W.

612	WD4PZN	614	EA2IA
613	KD9J		

S.S.B. Endorsements

310	YV5DFI/311	275	W0ULU/288
300	AA6AA/308	275	VE3FEA/287
300	EA2IA/308	250	VE3BGX/250
300	KM6B/304	150	I8WYD/156
300	W7OM/303	150	JH1LZC/155
300	KB8DB/302	Mobile	WA4YDK/M
300	K9HQM/302	3.5/7 MHz	KZ2P
275	W6NLG/293	3.5/7 MHz	KM6B

C.W. Endorsements

310	K4CEB/315	310	K6LEB/310
310	W8KPL/314	300	AA6AA/307
310	K6JG/313	275	EA2IA/281

Total number of active countries is 315. The basic award fee for subscribers to CQ is $4. For non-subscribers, it is $10. In order to qualify for the reduced subscriber rate, please enclose your latest CQ mailing label with your application. Endorsement stickers are $1.00. Updates not involving the issuance of a sticker are made free when an s.a.s.e. is enclosed for confirmation of total. Rules and application forms for the CQ DX Awards Program may be obtained by sending a business size, No. 10 envelope, self-addressed and stamped, to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. DX stations must include extra postage for air-mail reply. Please make all checks payable to the awards manager.

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in Arkansas will be the first Saturday in October this year.

The Sunspot Cycle

Cycle 21 continues to head for the pits, but eventually what goes down comes back up. That's to keep you living in hope for better days. Dr. Koeckelenbergh at the Sunspot Index Data Center in Brussels figures that the smoothed numbers will be 48 for July and 46 for August.

Jack Wichels, W7YF, writing in the *Totem Tabloid* of the Western Washington DX Club, notes that the best source for propagation conditions can be caught at 18 minutes past the hour on WWV. WWV gives current ionospheric stability data, these being the "Boulder K Index," and the numbers range from 0 to 9. Zero or 1 means a very stable or quiet ionosphere, 2 or 3 means abnormal or unsettled conditions, and a K-index of 4 or higher means bad news for sure. In actual practice you wil find that a K-index of 0 or 9 is rare, the numbers usually falling in between. The figures give the stability, or the instability, as measured at Boulder for the preceding three-hour period. If you are really looking for the word, chart the WWV report over several hours. You can look for disturbed conditions if the numbers are going up, and improving conditions if they are going down.

Ultraviolet rays and x-rays cause the earth's atmosphere to ionize at high altitudes. The ionization is strongest at a point directly under the sun. They represent a large bundle of electric charges moving at over a thousand miles an hour with respect to the earth. The motion means current flow, and this flow produces its own magnetic field, causing measurable changes in the geomagnetic field. These changes are smooth and small in any given three-hour period.

When there are explosions or flares on the sun, these charged particles produce their own magnetic field, which affects the earth's geomagnetic field. That's when you may find the auroral flutter on signal paths close to the poles, and maybe even blackouts or sporadic-*E* propagation on the higher frequencies of 6 and 10 meters.

Forecasts of band conditions made at long range are interesting and give an indication as to what can be expected. However, as with daily weather reports, it is not yet an exact science. The WWV reports are of current conditions and can give more of a now picture than a maybe one. Years back with a weekly bulletin it was clear that what you might project for a week in advance often was not what happened. But then again, that is also the way with DX news. What was anticipated sometimes does not show, and what was unexpected falls into your lap. So what does the Deserving DXer do? Follow the immortal words of Lord Baden-Powell, the Hero of Mafeking: Be Prepared! Listening to WWV can be part of the preparation.

Bouvet

Arnfinn Kristoffersen in downtown Oslo is pushing out the publicity on planning for a possible Bouvet operation later this year. There will be a Norwegian scientific expedition taking off from South America late this year for two months in the Antarctic area. Bouvet will be one of the stops.

The LA DX Group is involved in planning to get some 3Y action going when the research vessel stops in the area. The big problem at this point is that there will only be a brief stop at Bouvet—perhaps only one day, and at the best maybe three days or so. Thus, amateur radio operation is not a sure thing. Back in 1983 the LA DX Group set up a planning group for a Bouvet effort. Jorgen Hoel, LA5UF, is the project manager. Einar, LA1EE, is the assistant manager.

Should all the chips fall into place, the LA DX Group will aim for a 3Y Bouvet operation along about January or February of next year. At this point the transportation is the biggest hurdle. Then there will be concern about the expenses of such an effort. For some surprising reason, there does seem to be little if any problem in recruiting operators.

Anyone interested in helping with the problems of this 3Y Bouvet effort might need the address. It is 3Y-Bouvet Project, Jorgen Hoel, Munkerudasen 12E, 1165 Oslo 11 Norway.

Bouvet has been on most DXers' needed lists since Marconi played bocci ball in downtown Bologna. There never has been any big operations on the sub-Antarctic island. The last one was only for a brief period in January and February of 1979. There were a number of problems, but 3Y1VC and 3Y1DX were active at times, and the QRM from blind calling was there all the time. Only a handful of W/Ks got through, and we always remember the W6 who worked it one morning while idly tuning the dial. Was he excited with his success? Hardly at all. He had worked Gus Browning there previously about a quarter century back.

Log Duplications

Some DXers can get a bit up tight about dupes in the log, and this is especially notable in those who check logs for contests, awards, or even for QSLing for a DXpedition.

At the California DX Meeting a couple of months back Lloyd Colvin took the floor to note that problem and state a bit emphatically that he was getting weary of finding their logs for DX operations loaded with dupes, sometimes the dupes being logged within hours of each other, and others showing up day after day. As Lloyd and Iris are very serious about QSLing, they wanted the problem noted and asked for suggestions.

There were any number of suggestions, some intended to be helpful and others intended to minimize the problem, and still others tended to prove that no matter what the problem, someone always has a solution—neat, exact, specific, and wrong. Also impractical was a suggestion that the DX station maintain dupe sheets so that he can tell when the station calling has already been worked. Of course, that suggestion was in earnest!

The concensus was that the problem is only to be corrected at the source. Those submitting logs for contests or awards must cull their own lists. Those who happily work a DXpedition every hour they are on may eventually realize that some enmity is being engendered. Often this tactic is excused on the basis that they are only testing propagation conditions, or they want the DX station to know they are getting out, or maybe that their signal was better than the hour before. Don't you believe it!

Recently we heard of a prominent DXer whose application for an operating award was disqualified on the basis of duplications. Those handling the award could not believe that so many errors were unnoted.

There are contests starting to show on the horizon, and the big CQ WW Tests are not far off. If you are running up a big score or hear a big and rare DX station on, remember! It might also help to remember that some of these checkers are using computers in processing

---

5 Band WAZ

Standings as of May 1, 1984

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1. ON4UN
2. K4MQG
3. SM4CAN
4. AA6AA
5. W8AH
6. W6KUT
7. EA8AK
8. LA7JO
9. EA3SF
10. OH1XX
11. EA8OZ
12. W0SD
13. K0ZZ
14. ON6OS
15. OK3TCA
16. K6SSS
17. ZL3GQ
18. OK3CGP
19. SM0AJU
20. OZ3PZ
21. I3MAU
22. I2ZGC
23. 4Z4DX
24. N4KE
25. K5UR
26. K9AJ
27. SM3EVR
28. LA5YJ
29. DL3RK
30. N4WJ
31. G3MCS
32. SM5AQD
33. W0MLY
34. I0RIZ
35. ON5NT
36. OH6JW
37. OK1AWZ
38. IV3PRK
39. DJ6RX
40. OH3YI
41. I4RYC
42. ZL1BIL
43. I4EAT
44. ZL1BQD
45. TG9NX
46. XE1J
47. F5VU
48. W3AP
49. YO3AC
50. K3TW
51. XE1OX
52. VE7IG
53. OK1ADM
54. CT1FL
55. WA1AER
56. N4RR
57. UW0MF
58. W4DR
59. OK1MP
60. W1NW
61. OE1ZJ
62. HB9AHL
63. HB9AMO
64. LA6OT
65. UR2QD
66. UK2RDX
67. ZS5LB
68. F6DZU
69. DL4YAH
70. LA7ZO
71. W9ZR
72. W1NG
73. VK9NS
74. N4KG

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2. ZL1BOQ, 199
3. JA3EMU, 199
4. N4WW, 199
5. K9YRA, 199
6. W8VUZ, 198
7. LA9GV, 198
8. W6GO, 198
9. K4CEB, 198
10. OK1MG, 198

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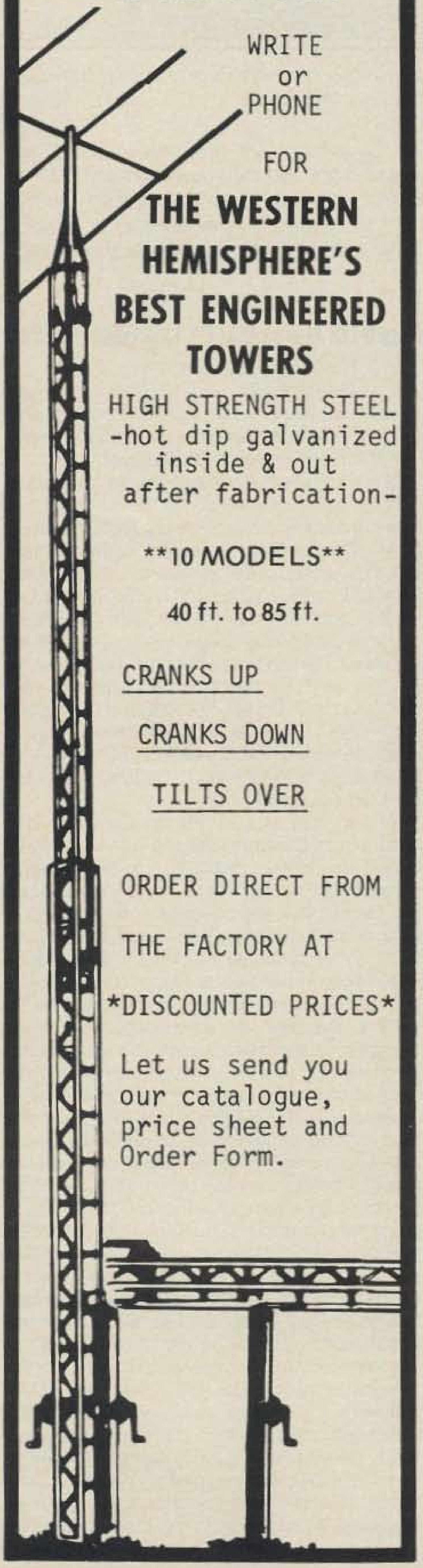

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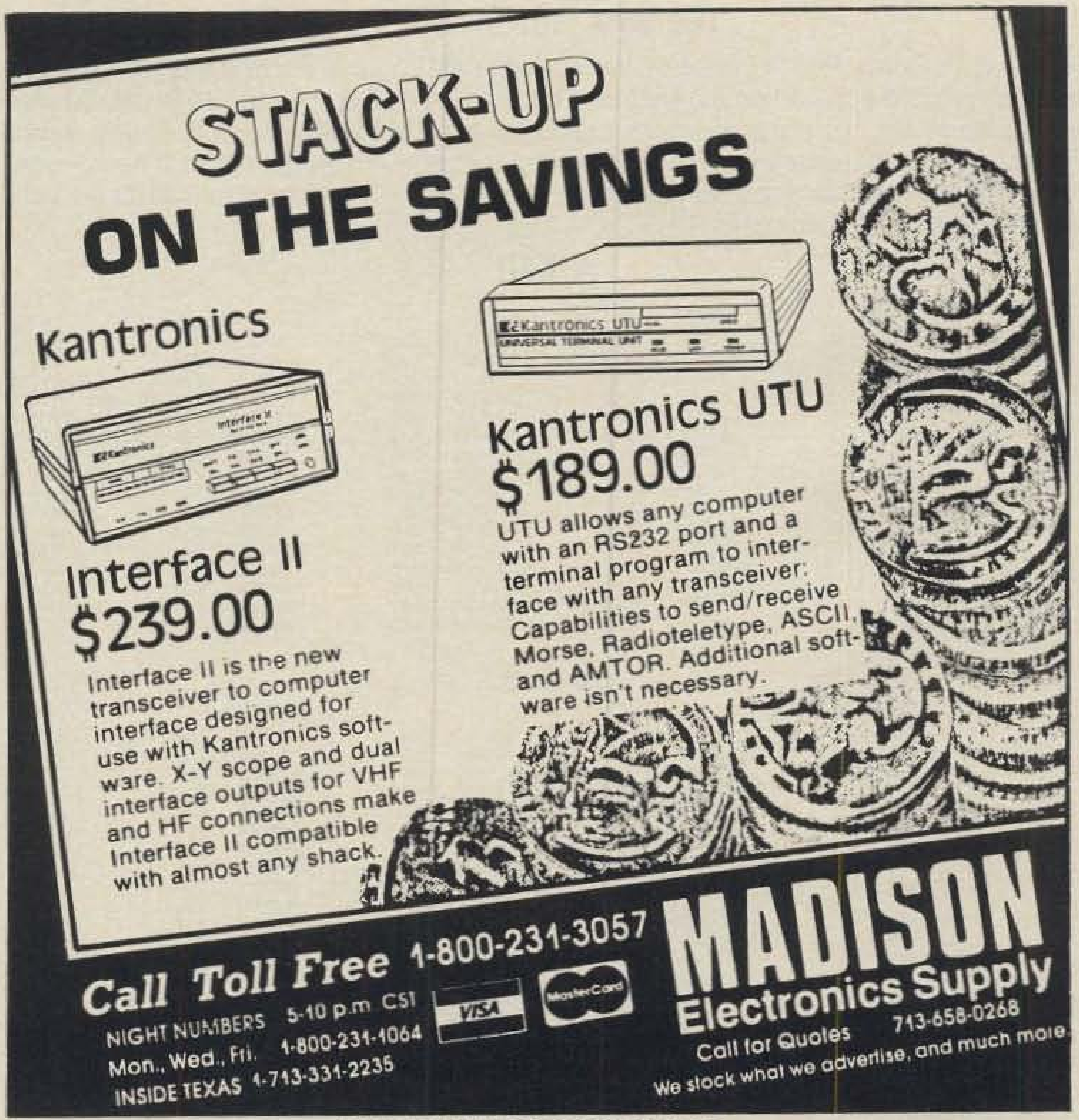

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MIXED

2969	YU7DX	1733	N4UU	1381	IN3ANE	1017	K2QF	843	AI6Z
2614	YU4HA	1730	K5UR	1356	N6FX	1005	NN4Q	837	VE2FOU
2495	F9RM	1660	YU7AW	1335	SM3EVR	1003	N3ED	827	PY1DFF
2488	YU2DX	1657	N2AC	1291	K8LJG	999	W6OUL	798	WA8YTM
2299	W2NC	1648	YU7BPQ	1240	N6AW	999	G3ZRH	783	K7CU
2292	K6JG	1636	YU2RTW	1231	N6JM	997	KA3A	776	VE2PD
2200	K6XP	1631	W8CNL	1212	PY4OD	994	YU2CBK	770	WD4RAF
2190	VE3GCO	1592	I8YRK	1187	JH1VRQ	992	W8ILC	742	JH8NYK
2175	K2VV	1554	YU1DZ	1174	W8RSW	990	YU2CQ	730	K2POF
2024	N4MM	1503	K9BG	1164	CT1LN	982	N4IB	730	N2AIF
1976	W4BQY	1496	I6SF	1154	W7CB	956	WD9IIC	707	OE1KJW
1964	W9DWQ	1461	W0SFU	1153	KL7AF	955	N3RL	696	KJ7N
1951	YU7BCD	1426	I2PHN	1140	I2MQP	951	KO8T	690	K8HF
1838	N4NO	1415	WA1JMP	1131	W1NG	915	N8BJQ	662	K9LJN
1783	N6JV	1401	K6DT	1050	WB8ZRL	896	W0JIE	683	WB1GOO
1755	N9AF	1397	K6ZDL	1034	YU7AJD	892	W6YMH	603	ND6U
1748	N6CW	1388	KF2O	1018	G4FAM	876	DK2BL		

S.S.B.

2409	F9RM	1495	I6ZJC	1081	KF2O	944	KL7AF	765	W6LQC
2227	I0ZV	1479	K5UR	1077	WA4OIB	939	XE1OX	762	VE2PD
2028	I0AMU	1450	W9DWQ	1076	ZP5RS	926	KC8CC	759	CT1BY
1973	K6JG	1396	YU7AW	1076	W2CC	908	WB6GFJ	748	N3ED
1958	K6XP	1365	N4NO	1064	G4CHP	900	K8LJG	747	N3RL
1894	K2POA	1355	W4BQY	1030	KC4OV	894	AC2J	744	W3GXK
1867	K2VV	1341	N2SS	1025	N6FX	888	W2LZX	738	W0ULU
1846	ZL3NS	1341	WA4QMQ	1023	CT1FL	864	WA2FKF	707	WB6SRK
1821	N4MM	1335	WD8MGQ	1012	WF4V	859	W1NG	700	EA7AZJ
1695	I4ZSQ	1267	N4UU	1006	CT4NH	844	NN4Q	693	ON6IT
1686	HB9AAA	1217	I2PHN	1005	W6YMV	817	I1POR	667	JH5FQO
1604	W0YDB	1208	WB2NYM	1002	WB8ZRL	810	I0SGF	636	KB0C
1600	I0MBX	1208	VE1YX	996	YU7DX	799	KC8YM	636	WO4L
1588	I8YRK	1203	I6NOA	996	TG9GI	798	N4IB	615	WN5MBS
1586	I8KDB	1138	I2MQP	992	I8KCI	796	W3ARK	611	YB0ACL
1578	YU7BCD	1136	PY3BXW	975	I1HAG	795	PY4OD	610	PY4VX
1567	CT1UA	1085	W2CC	953	N2AC	792	Z21GJ	606	KA3A
1551	OZ5EV								

C.W.

2072	W2NC	1573	YU7BCD	1334	YU7SF	1032	I1YRL	752	NN4Q
2010	W8RSW	1561	W9DWQ	1292	YU7AW	1004	JA1KRU	744	KA3A
1985	YU7DX	1537	W3ARK	1278	4X4FU	990	PY4OD	734	AG5C
1790	W8KPL	1521	W4BQY	1274	W9FD	921	K9LJG	702	JA5SIX
1759	WA2HZR	1515	G2GM	1262	LZ1XL	848	W1IHN	700	VE2FOU
1746	N6JV	1469	VK4SS	1258	I6SF	847	KL7AF	694	AI6Z
1729	K2VV	1480	N2AC	1227	YU3NP	828	W1NG	687	G4FAM
1722	DL1QT	1425	N4UU	1180	K6ZDL	822	KA7T	664	YU2CQ
1690	K6JG	1390	N4MM	1099	N6FX	795	AK9Z	652	OE1KJW
1638	ON4QX	1389	VE7CNE	1092	W4WJ	781	N3ED	603	N2AIF
1627	K6XP	1352	K5UR	1087	N4YB	767	DJ1YH	600	N3RL
1605	N4NO	1345	VO1AW	1032	JE1JKL				

Here are some well-known DXers at the International Air Terminal on Easter Island. From the left are Fernando, CE0FQV; Iris and Lloyd Colvin, W6QL and W6KG; and Father Dave Reddy, CE0AE, the best chance for Easter Island by the Deserving in the last decade. Years back Father Dave was a W2. He is a member of the Order of Franciscan Minors (OFM). Iris and Lloyd were at Visalia and Dayton this year. (YASME photo)

awards, and anything not exactly correct pops right out of the video display. Where things are run on the honor system, there are recurring instances in which over-achievers are asked to submit the cards. Lists aren't good enough.

LU3ZI QSL Cards

The Grupo Argentino de CW has a feeling that a large number of cards sent via some bureaus have run into the Land of the Lost QSLs. Some 12,000 QSLs have been sent out for this operation, these being included in some 4400 envelopes or small bundles.

If you still want the LU3ZI card for South Sandwich, you had better go direct: Grupo Argentino de CW, Carlos Diehl 2025, 1654 Longchamps, Buenos Aires, Argentina. The Grupo also has problems with QSLs sent through third parties without s.a.s.e., and if your needed one fits that pattern, it might be wise to try again direct with s.a.s.e. There are some currency problems, so be sure to send adequate postage to cover the mailing.

The Grupo does issue a DX Bulletin in Spanish for $5.00 a year subscription. Send info to Carlos A. Rodriguez, LU2FDX, the club treasurer, at the address given above for QSLing.

There are calls in this group which should be recognized by all DX types: F8RV, DJ9ZB, ON5NT. The photo was taken at the Clipperton DX meeting in Paris last year. From the left: Jean Emery, F8RV, Franz Langner, DJ9ZB, Ghislain Penny, ON5NT. Franz, in the center, is considered one of the top DXers in the world.

Some DX Notes Out Of The Back Pocket

The Northwest DX Convention comes the last weekend in July at the Greenwood Inn, Beaverton, Oregon, just outside Portland. The Williamette Valley DX Club, Box 555, Portland, OR 97207 will be the host this year.

The Kansas City DX Club newsletter recently listed some needed books for the DXer's library, including *After 5BWAZ, What's Left* by I. M. Dunn. Club president John Chass, W0JLC, noted the problems in working 5BWAZ in the low bands, 80 meters always being the tough nut to crack. But with the bottom of the cycle coming up and high bands withering away, the next year or so will be best to fill out the numbers needed. Also, with the new DXCC certificates for 160, 80, and 40 meters there should be a lot of action developing. It might be noted that it took W0JLC about 2½ years to work WAZ on 80. It will be easier for the next couple of years.

At the start of summer the Canadian Department of Communications was being petitioned to remove most, if not all, subband restrictions for VE amateurs. If the petitions are successful, the changes may come in a year or so, but possibly not until 1986. Comment on the proposal indicates that the move is a "comprehensive solution" to imminent U.S. phone band expansion on 10, 15, and 75 meters. The only restrictions would be "gentleman's" agreements, such as they may be. If you wonder how all of this got started, it goes back to pre WW II, when in some meetings in what is now ITU Region II, the U.S. took the lead to bring some order to the amateur bands and suggested subbands. Everyone present thought it was a great idea and adopted it. However, everyone else thought that it was a great idea for the U.S., but that other countries had special needs and should not be bound in the carefree use of the bands. It is a half century later, and a lot of complaining still exists.

A quarter of a century ago when one read about an amateur being nailed by the FCC, it usually was for excessive power. Contest periods were the caution times, and many well-known DX types were very circumspect about operating at reduced power during such tests, the FCC being out with mobile vans to watch suspected achievers. We have not noted one of these for the last couple of decades, although possibly there has been such. There are often citations and license suspensions, however, and usually they are for malicious interference.

The question of country status for the Pribilof Islands is being run through the mill again. The last time it was a standoff: 8 yeas and 8 nays. There is currently some action, with WB4BSJ/KL7 being on St. George Island in the Pribilofs. He will be there until next June. Look for him around 14265 kHz and 0700Z, give or take a bit. QSL to St. George School, St. George Is., Alaska 99660.

A couple of months back it was reported that the area around the operations of XU1SS and XU1KC had been overrun by Viet troops. Back in May Mike Watanabe, JH1KRC, had an article in *CQ* on how these stations were brought on the air.

SU1ER has been heard out of Egypt on 80 meters. Possibly by this time you might also be hearing SU1MR on 40. Boyd Shelton, W4ZWE, was in the country hoping to be on the air himself, but he was not successful. However, he was successful in getting some of the locals going.

Starting in January France will show with some new prefixes, a letter being added to the French prefix to show license class. The Clipperton project aimed for earlier this year is still alive and may go this fall, possibly as early as September. The gear is in storage, but indications are that the landing permission will be extended, and hope still burns brightly. Some agitation is going forth for country status for the British bases on Cyprus. Jim Cain in the *DX Bulletin* reports that the two British bases are under British sovereignty, the ZC4 callsign being used. Live in hope! DXers will always need new countries, and somehow something will be found that qualifies.

The JA DXpedition aimed at Taiwan did not come off as planned and was rescheduled for mid-summer. By the time you read this it may be over, or it still may be coming. When Marty was there in April, he ran up some 12,500 QSOs, Marty, OH2BH, and PA0GAM doing the performance. Wallis Island is reported as on rather regularly at 14279 kHz from 0800Z on Tuesdays.

If you want to find a cool spot this month, think Svalbard. The local club at Longyearbyen has cornered a small building for a station location and plans are to make it available to the visiting Deserving DX types. The island group is on regular SAS flights, and anyone thinking of going should contact Mathias Bjerrang, JW5NM. He is also LA5NM and is in the callbooks.

It is not too long until the *CQ* WW Tests in October and November, but there is still time to get ready. The lower bands should be much better than in recent years, and antennas should be improved to take advantage of the conditions on 40, 80, and 160 with the solar cycle headed nowhere but down. In other cycles some DX types have even gone to the extent of changing the Yagis, abandoning 10 and even 15 meters completely, and trying to fly a 40 meter beam. One can dream of an 80 meter quad, or even with lessened expectations some full-size 80 meter verticals. Any improvement will help.

Never forget! Frank Anzalone, W1WY, expects every DXer to do his duty. The *CQ* World-Wide DX Tests are at hand. Prepare!

DX Ten Years Back

Back in August 1974 a DXpedition to Desroches was just getting underway. AC3PT showed from Sikkim with UA9VB running interference. ZA1A, ZA1AN, and ZA1AF were being heard and worked. Were they good? They are still waiting for the QSLs! W2OVC was entangled in legal battles over his tower in Westchester County. Lenny is now W5OVC and still unreconstructed. VS5MC went out to scout and patrol the Spratlys. After finding some unfriendly types already entrenched, Maurice thought things looked better in another direction. PQ0NS and PQ0ARM were on from Fernando de Noronha, and VK9YY was active from Cocos Keeling. UA0FGM was being heard from Sakhalin Island; Walt is now heard back in Moscow as UV3GM. JA1OCA was heading for C21DX; 5T5GS was on from Mauritania; and 9K2DX was on from Kuwait, FB8ZC from New Amsterdam, and PA0IWH/S2 from Bangladesh. Those who brought Kingman Reef on as a new country reported it as 900 feet long and 15 wide at high tide. YV8AL on Aves lost the antennas when brushed by a hurricane but came back for more action.

73, Cass, WA6AUD

QSL Information

KM7Z offers a free stateside QSL service. It is a voluntary service. Your outgoing QSLs are taken when presorted by call areas and alphabetically, and you send an s.a.s.e. for any due to go back to you. If you want more information, write to U.S. QSL Service, Box 814, Mulino, OR 97042.

DU5Q is Mindinao Slim. W6HHG knows nothing of this one. Jim Lane, KN4F, 5104 Pilgrim Road, Memphis, TN 38116, is volunteering for service as a QSL Manager. The Lord Howe operation signing VK2LHI goes to WA2BFW for VE/W-Ks; all others go direct to VK2WU, Box 31, Winmalee, NSW, Australia 2777. This corrects previous information. Cheryl Whitlock, N4JFV, Rt 1, Box 244B, Opelika, AL 36801, is an other volunteer as a QSL Manager for a DX station.

Charles McCarthy, W1BK, says he is *not* the QSL Manager for TA1BK.

All of the following was accomplished with the aid of W9LNQ, a watcher of the lonely nights.

F5RV/TK to F5RV
F6HIX/J73 to F6EYS
FG0IHU/J73 to F6EYS
FK0AQ to F2BS
HB0CBJ to DJ1BP
HL9JT to N2AEW
H44SH to AD1S
H44SA to AD1S
IT84KFQ to IT9ZGY
IT84VDQ to IT9TQH
JT1BR to JT-Buro
JT0DJT to I8YGZ
OH0BA to OH2BAZ
T77C to 84 CB
TE5DX to TI2CF
TI0HE to TI2VVR
VK2LHI to WA2BFW (VE/W-K only)
U9Z to UA9YEW
K8PYD/VS6 to K8PYD
XX9YD to K8PYD
ZF2AH to WA6VNR
ZM7VU to F6DYG
A4XJP to BERS, P.O. Box 230, Misirah, Oman
AH2AZ to POB 545, Agana, Guam
CE0FCM/CE0Z to B.P. 3016, Valparaiso, Chile
F6GKB/F08 to B.P. 5044, Pirae, Tahiti
HL4XM to Kwangju 500, South Korea
IT84FXY to P.O. Box 212, Marsalla, Sicily
H44R to P.O. Box 258, Honiara, Solomon Islands
YB4FU to P.O. Box 27-50, Bangka, Indonesia
YB9ARN to D. Brooks, Box 54, Jayapura, Irian, Indonesia
VK2LHI to Les Cullen, VK2WU, P.O. Box 31, Winmalee, NSW, Australia
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CIRCLE 73 ON READER SERVICE CARD

Asking the right question is half of the answer. W8HXR asked himself the question, from which evolved the answer to his antenna problem.

THE SKY PLANE ANTENNA

BY JERRY SWANK*, W8HXR

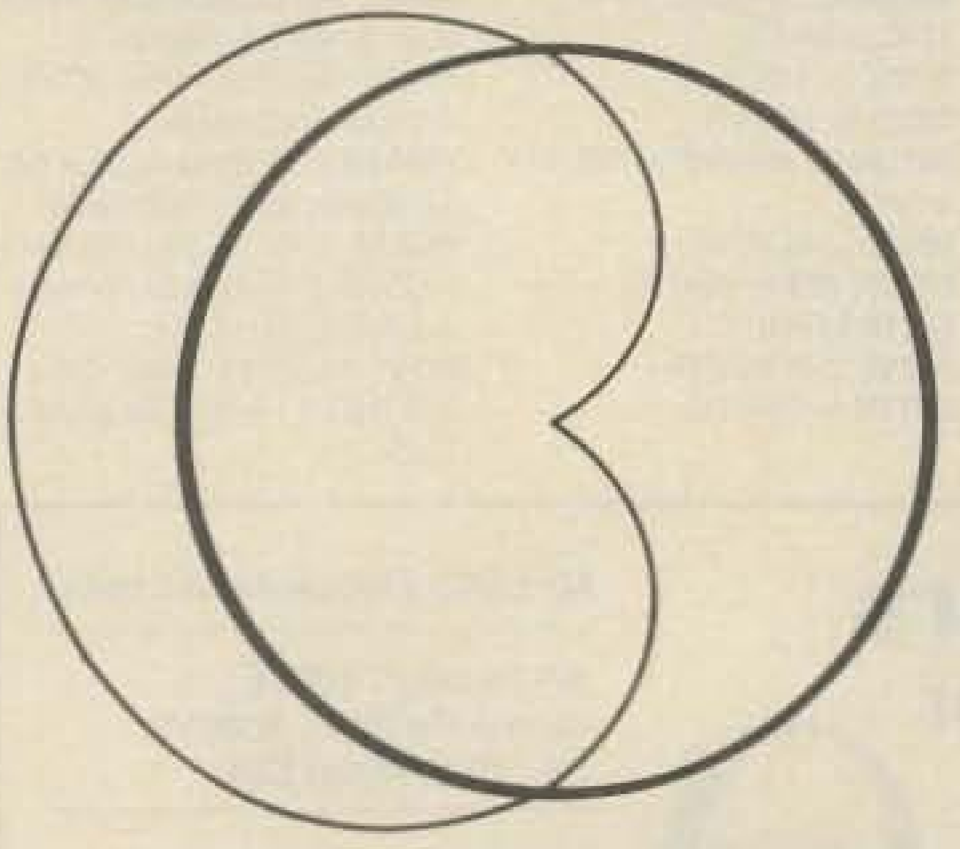

Fig. 1– The quarter-wave cardioid radiation pattern for an array of two antennas fed with equal magnitude currents.

At last, a new antenna—an inverted ground plane, which I have named "The Sky Plane."

I have a 20 meter Bobtail Curtain which fires north and south, but I wanted it to fire east and west. It is an excellent antenna and I easily work the Antarctic barefoot with it, and have done so even in a pile-up with 5/9 reports. However, I wanted to be able to talk with two amateur friends, one in Arizona and one in New Mexico, and a dipole just didn't make it very well. My yard was not large enough to allow the Bobtail Curtain to be turned around because of the requirement for a half-wave separation between the verticals. I wondered what it would be like to make a single-element Bobtail for omnidirectional propagation. As you may know, the reason for the fine performance of the Bobtail is the fact that the high-current point is up a quarter-wave above ground instead of at ground level, and an extensive ground is not required. A single ground rod about 8 feet long is enough. Radiation is best at a high-current point on an antenna.

The more I thought about this, the more convinced I became that it was a very good idea. In fact, by using the verticals as separate antennas, I could use quarter-wave spacing with a quarter-wave delay line and have a cardioid pattern (see fig. 1), and I could make the pattern reversible.

A pair of Sky Planes can be fed with equal lengths of coax, and the delay line can be added inside the shack with a two-position switch as shown. The simplest and most effective pattern is with quarter-wave spacing and quarter-wave delay. This has a gain of about 4.5 dB in the direction of the delay, and as much as 40 dB rejection in the opposite direction. A ground-plane antenna is at best a quarter-wave above ground, but that requires some sort of support. The Sky Plane furnishes its own support. Of course, it must be fastened at the base to an insulator because of the high voltage there.

The feeding method is the regular voltage-feed at the base of the antenna. I used a 4 foot length of 1¼ inch water pipe with about 10 inches sticking out of the ground, and over it I slipped a length of PVC tubing about 18 inches long. I inserted a bolt through the pipe and the PVC tubing and then put the vertical radiator of 1 $\frac{15}{16}$ OD aluminum tubing on the outside of the PVC tubing. I ran a bolt through this tubing and the PVC tubing so that the bottom of the aluminum radiator was about 3 inches above the pipe in the ground. The base of the radiator is at high voltage, and the capacity between the radiator and mount makes tuning very difficult if it is too close. I drove an 8 foot copper-plated ground rod alongside the pipe in the ground and attached the base of the tuning unit to it. The "radials" are the same length as the radiator (16½ feet) and have insulators at the end away from the antenna.

For a tuning coil I used a tuning unit from an old BC-610 transmitter, which has a coupling link. However, you can make your own coil from about No. 12 or larger wire, with the shield attached to the ground rod and the center conductor connected to the coil about three turns from the bottom. I used a coil with 3 inch diameter, ⅜ inch spacing, and 6 turns.

I tuned the coil and capacitor to 14.2 MHz inside the shack with a grid-dip oscillator and mounted them inside a plastic box with an SO-239 for the coax connection. I brought two lengths of cable out of the box for connection to the ground and the antenna. The "cable" was made of shielding stripped from a length of RG8 coax.

The settings can be checked with an s.w.r. bridge at the antenna, adjusted for minimum s.w.r. with the capacitor, and then finally adjusted for 1:1 by varying the tap a quarter turn at a time. To avoid this last adjustment I used an L network inside the shack. I used a two-tone generator at very low level for my s.w.r. adjustments at the antenna.

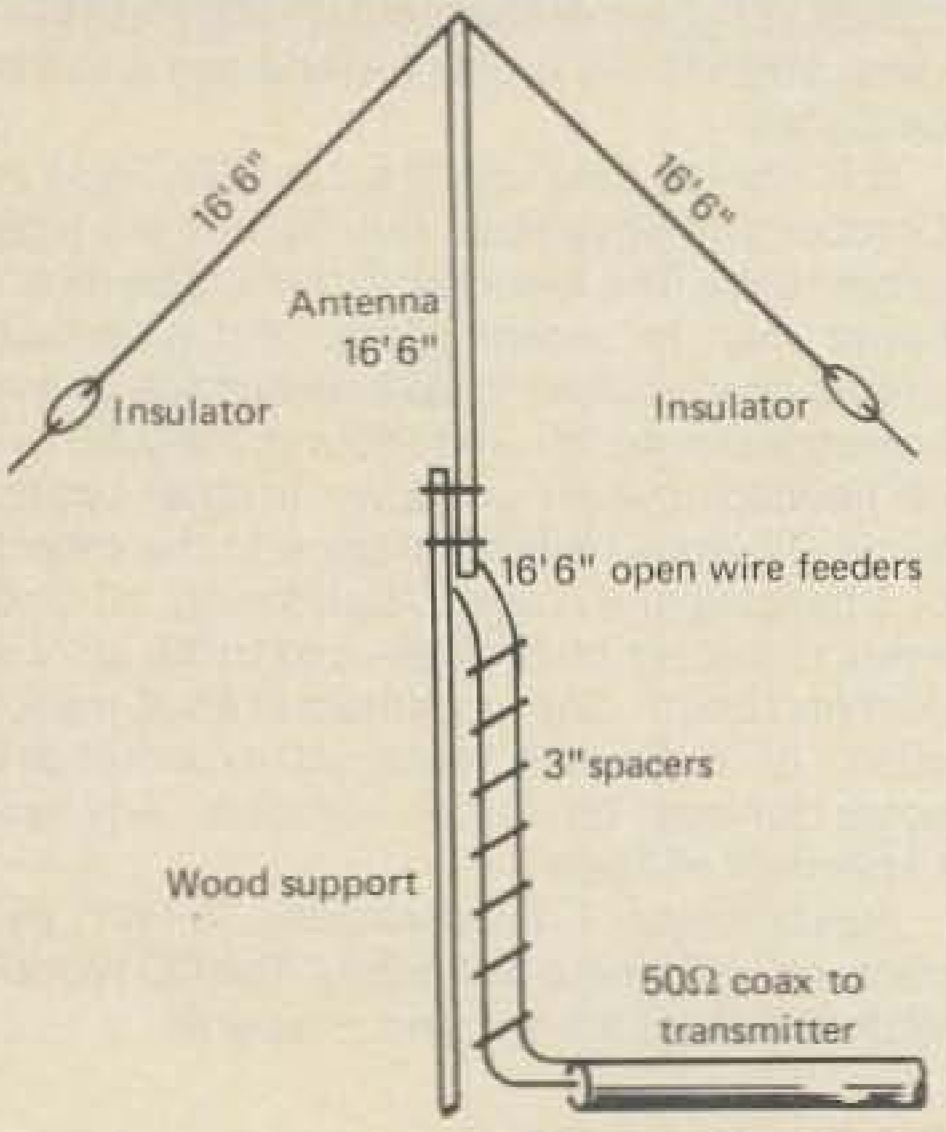

Fig. 2– The Zepp-fed Sky Plane antenna described in the text.

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*657 Willabar Dr., Washington Court House, OH 43160

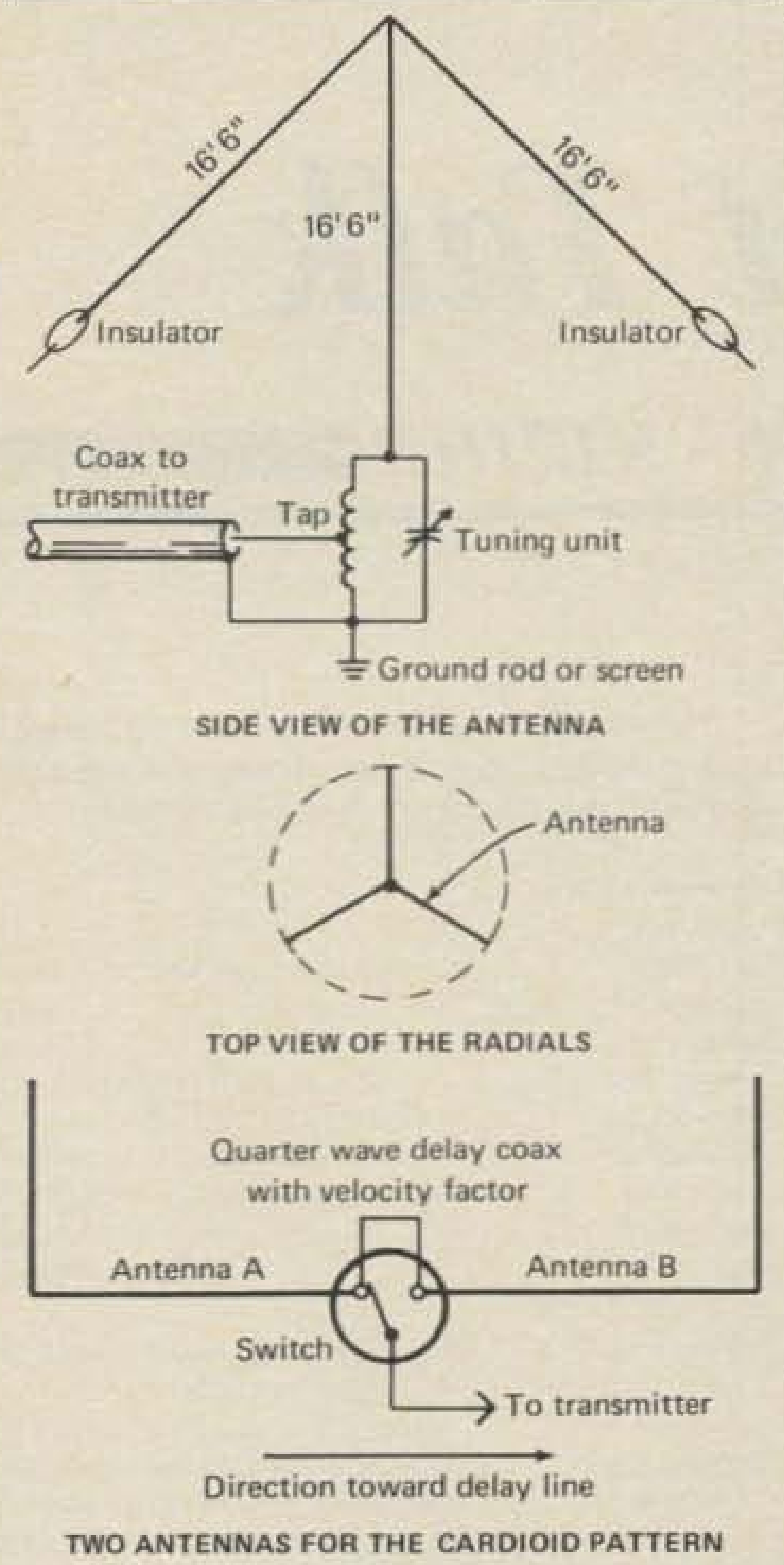

Fig. 3– At the top is the Sky Plane antenna matching network, at the center is the equidistant pattern for the radials, and at the bottom is the method of using two antennas with a quarter-wave delay line.

This antenna could be fed in other ways, of course. It could be current fed at the top of the vertical, with the coax pulled away from the antenna to keep it out of the field of radiation. Or, it could be Zepp fed as shown, with the base of the antenna supported about a quarter-wave above ground. Of course, this takes away the simplicity of the "Sky Plane," which supplies its own support but is higher. Actually, it will work with only one "radial." This will give a combination of horizontal and vertical polarization, but of course the antenna is then a half-wave vertical with the top half bent down. I prefer three radials, so they can be used as guys, and the polarization is then mostly vertical.

Remember that a vertical is a low-angle radiator, and it is at its best over 1500 miles out. It is not a good short-range antenna compared to a dipole. It would be well to have a horizontally polarized antenna for short and medium range, and also for receiving if you have much man-made electrical interference on a vertical antenna.

The Sky Plane is just what I needed and works very well. I think it may become a popular antenna. It is simple, take up very little space, and doesn't cost much. CQ

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The new rules say the FCC no longer prepares Novice Class written tests. Now what do you do when you have to administer one? Simple! Just use one of the written exams contained in our new *Official Novice Class Written Test* **packet. Each package contains ten (10) different multiple choice written tests (with 20 questions each). All answers researched. Uses questions from FCC PR Bulletin 1035A. Your student's answer sheets and your master answer key are also included. Complete & detailed instructions are enclosed on exactly** *how to legally comply with the FCC's new and different Novice Class licensing requirements.* **We'll have updated exams available whenever the FCC adds more questions. This is the package that YOU would design! An amateur radio operator written test need not be an "amateur" piece of work. Be professional!**

The Bash Novice book sells for $9.95 + $2.25 s&h (1st class mail), and the Novice exam packet sells for $9.95 + $2.25 s&h. California residents must add 65¢ sales tax to *each* order. Club discounts are available on quantity orders direct from the publisher. Call for details.

You'll find these and many other Bash products on sale at your favorite dealer. Be sure to visit our booth at the Dayton Hamfest. Remember, if you have any questions regarding FCC rules or test information, call us for immediate answers! We're here to help you! Our latest General, Advanced, & Extra test guides are current!

Bash Educational Services, Inc.
Mail: P.O. Box 2115 • San Leanoro, CA 94577
Offices: 1510 150th Ave. • San Leandro, CA
Phone us at (415) 278-8275 from 10 AM - 6 PM
Visa and MasterCard are always welcomed

CIRCLE 138 ON READER SERVICE CARD

Ticket Talk

by Dick Bash - KL7IHP

Welcome to the August installment of Ticket Talk, a column devoted to answering questions you may have about the amateur radio licensing structure. If you still have questions, please write to me either c/o *CQ* or at the address shown below. A reply will be sent to those enclosing a self-addressed, stamped envelope. If you can't wait for an answer, either call me at (415) 278-8275 or call your local FCC Field Office.

Statistics on the Volunteer Tests Given at the 1984 Dayton Hamvention

We received from Judy Frye, KG8P, the results of the volunteer exams given at the 1984 Dayton Hamvention the last week of April. Judy was in charge of the program this year, and her team did the finest job of exam administering that we have ever seen. However, **the overall failure rate at Dayton was 57%.** They gave the 5, 13, and 20 w.p.m. code tests plus the Novice and Technician/General written exams to 364 people (a total of 517 tests). It's interesting to note that 21% of those who registered for the exam(s) didn't show up to take them. *What did these "no-shows" know?*

General, Advanced, and Extra Frequencies

As I mentioned in the July column, I am including a list of the frequencies that General, Advanced, and Extra Class licensees may use. The v.h.f./u.h.f./s.h.f. frequencies are all the same for each of these three license classes and are given just once. The difference among these licenses is the h.f. privileges. Clip this out, make a zillion copies of it, tape it up in your shack or your favorite ham store, and give it to everyone in your club!

General Class License

Kilohertz (kHz)	
1800 to 2000	A1,A3
3525 to 3775	A1,F1
3890 to 4000	A1,A3,A4,A5,F3,F4,F5
7025 to 7150	A1,F1
7225 to 7300	A1,A3,A4,A5,F3,F4,F5
10100 to 10109	A1,F1
10115 to 10150	A1,F1
14025 to 14150	A1,F1
14225 to 14350	A1,A3,A4,A5,F3,F4,F5
21025 to 21250	A1,F1
21350 to 21450	A1,A3,A4,A5,F3,F4,F5
28000 to 28500	A1,F1
28500 to 29700	A1,A3,A4,A5,F3,F4,F5

Note: Whenever *any* licensee is operating on the Novice Class frequencies (3700–3750 kHz, 7100–7150 kHz, 21100–21200 kHz, or 28100–28200 in the 50 States), he or she may not exceed 200 watts peak envelope power. If you're on the Novice bands, turn that linear off!

The other frequencies the General (as well as the Advanced and Extra) may use are *all* of the amateur frequencies above 30 MHz.

Megahertz (MHz)	
50.0 to 54.0	A1
50.1 to 54.0	A2,A3,A4,A5,F1,F2,F3,F4,F5
51.0 to 54.0	A0,F0
144.0 to 148.0	A1
144.1 to 148.0	A0,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5
220 to 225	A0,A1,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5
420 to 450	A0,A1,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5
1215 to 1300	A0,A1,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5
2300 to 2450	A0,A1,A2,A3,A4,A5, F0,F1,F2,F3,F4,F5,P
Gigahertz (GHz)	
3.300 to 3.500	A0,A1,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5,P
5.650 to 5.925	A0,A1,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5,P
10.000 to 10.500	A0,A1,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5
24.000 to 24.250	A0,A1,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5,P
48.000 to 50.000	A0,A1,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5,P
71.000 to 76.000	A0,A1,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5,P
165.000 to 170.000	A0,A1,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5,P
240.000 to 250.000	A0,A1,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5,P
Above 300.000	A0,A1,A2,A3,A4,A5,F0,F1,F2,F3,F4,F5,P

A0 and F0 are the same (for our purposes) and represent an unmodulated a.m. or f.m. carrier. An example would be holding down your c.w. key and not letting it up. A1 means Morse code for us, while F1 means h.f. RTTY (radioteletype) for our purposes. A2 represents v.h.f./u.h.f. RTTY, and F2 stands for the type of tones that you hear on a Touchtone™ (a trademark of Bell Labs) phone. A3 is a.m. voice and can also be used to indicate s.s.b. or d.s.b. F3 is f.m. voice. A4 and F4 are amplitude and frequency modulated facsimile (like weather maps pilots get at the Flight Service Station; it's the transmission of pictures onto paper, basically), while A5/F5 represents amplitude and frequency modulated television. To the best of my knowledge, there is no differentiation between fast- and slow-scan television. The P stands for pulse emissions.

Advanced Class License

The Advanced Class licensee may use any of the above listed General frequencies as long as he/she uses the permitted emission. Here are the current h.f. allocations for Advanced Class license holders:

Kilohertz (kHz)	
1800 to 2000	A1,A3
3525 to 3775	A1,F1
3800 to 4000	A1,A3,A4,A5,F3,F4,F5
7025 to 7150	A1,F1
7150 to 7300	A1,A3,A4,A5,F3,F4,F5
10100 to 10109	A1,F1
10115 to 10150	A1,F1
14025 to 14150	A1,F1
14175 to 14350	A1,A3,A4,A5,F3,F4,F5
21025 to 21250	A1,F1
21270 to 21450	A1,A3,A4,A5,F3,F4,F5
28000 to 28500	A1,F1
28500 to 29700	A1,A3,A4,A5,F3,F4,F5

Extra Class License

The Extra Class licensee has full amateur privileges. Here are the **complete** h.f. privileges for Extra Class license holders at the time of this writing (May 21, 1984). Keep in mind that the Extra and Advanced also have the same privileges on the v.h.f./u.h.f./s.h.f. bands as the General and Technician classes.

Kilohertz (kHz)	
1800 to 2000	A1,A3
3500 to 3775	A1,F1
3775 to 4000	A1,A3,A4,A5,F3,F4,F5
7000 to 7150	A1,F1
7150 to 7300	A1,A3,A4,A5,F3,F4,F5
10100 to 10109	A1,F1
10115 to 10150	A1,F1
14000 to 14150	A1,F1
14150 to 14350	A1,A3,A4,A5,F3,F4,F5
21000 to 21250	A1,F1
21250 to 21450	A1,A3,A4,A5,F3,F4,F5
28000 to 28500	A1,F1
28500 to 29700	A1,A3,A4,A5,F3,F4,F5

There are a few other points worth noting, although they will not apply to most readers. Alaskan readers should note the following provision in 97.61(b(13)) of the current Part 97 of the FCC Rules and Regulations:

The frequency 4383.8 kHz, maximum power 150 watts, may be used by any station authorized under this part to communicate with any other station authorized in the State of Alaska for emergency communications. No airborne operations will be permitted on this frequency. Additionally, all stations operating on this frequency must be located in or within 50 nautical miles of the State of Alaska.

Alaskans who use the frequency of 4383.8 kHz for the purposes outlined in the Rules may use full carrier a.m. or s.s.b.

Licensees in the South Pacific should note that 97.61(b(3)) applies to them and says:

3900–4000 kHz and 7100–7300 kHz are not available in the following U.S. possessions: Baker, Canton, Enderbury, Guam, Howland, Jarvis, the Northern Mariana Islands, Palmyra, American Samoa, and Wake Islands.

Licensees who are outside of Region 2 (basically this means *not in the 50 States, the Caribbean, or North or South America*) are permitted A3 and/or F3 emissions from 7075 to 7100 kHz, as per 97.61(b(11)).

All of this is hard to stay up to date with, isn't it? Well, here's a commercial!! There are only two ways to keep abreast of all the changes to Part 97. First, and at the greatest expense, you can subscribe to the *Federal Register* and that costs $300.00/year. Alternately, you can subscribe to our Part 97 service for only $14.95/year. You're sent an attractive 3-ring binder, a set of current regs, and a pack of revisions about every 60 days for a year. The rules printed in other publications are out-of-date the day they're printed. If you and/or your club wants to stay current, then you really have only two choices. Order a subscription and save yourself some grief. Sorry about the commercial, but this is a good service and we do it as cheaply as we can.

That's it for this month. See you in September! Please, get to an **FCC** testing facility and **get upgraded soon.**

Bash Educational Services, Inc., P.O. Box 2115, San Leandro, CA 94577.

Ignorance Of The Law Is No Excuse!

F.C.C.
Part 97
Rules and Regulations for Amateur Radio Operators
Bash Educational Services, Inc.

And chances are that the last time you studied the rules and regulations of the FCC pertaining to Amateur Radio was the first time you studied for your Ham ticket. The fact of the matter is that if you haven't made the study of Part 97 of the Rules and Regulations part of your steady reading diet, you don't know that most of the regulatory details you so diligently studied 3 or more years ago have changed drastically. Don't wait for that Official Observer in East Podunk to inform you that the laws have changed since you and H.P. Maxim were kids together.

You owe it to yourself and to your hobby to be fully informed . . . not by hearsay or re-hashed rumor, but by the actual Rules and Regulations . . . word for word, comma for comma . . . and completely up to date. You owe yourself the Bash Educational Services Part 97 Rules.

This isn't just a rule book. It's a subscription to a service by Bash Educational Services, Inc. which provides a rugged 3-ring binder with the complete FCC Rules governing Amateur Radio, and replacement pages covering all changes, mailed to you by 1st class mail every other month for a year.

Send $14.95 for the complete FCC Part 97 Rules and Regulations for Amateur Radio Operators and one full year's update service. Order your copy today. Makes a great gift for a friend or a club, too!

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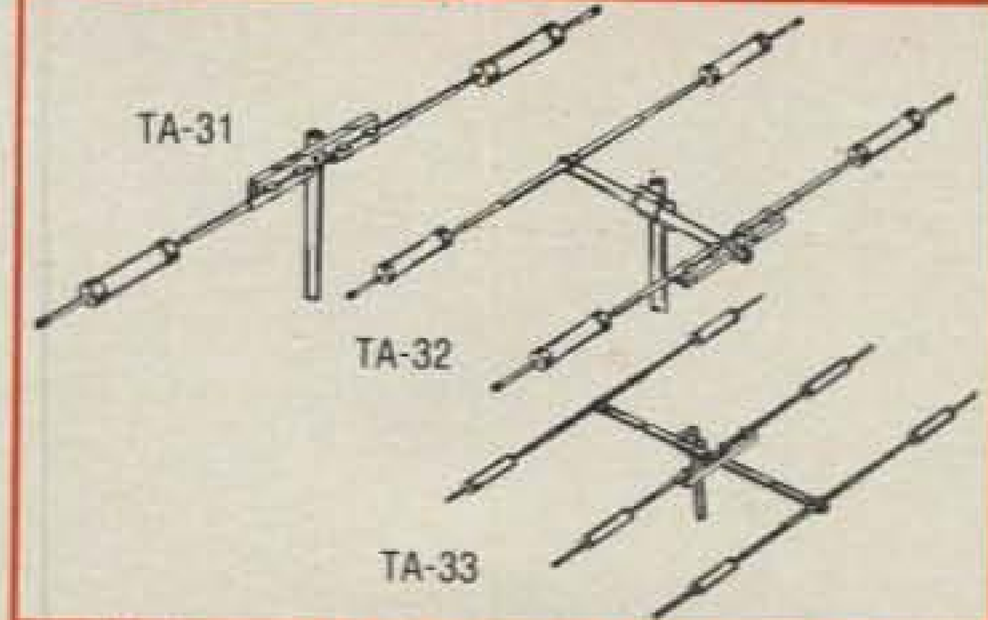
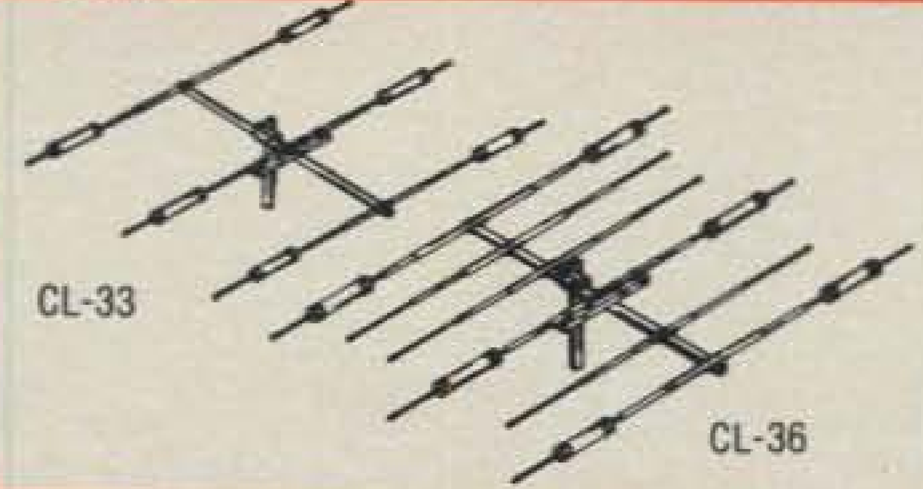
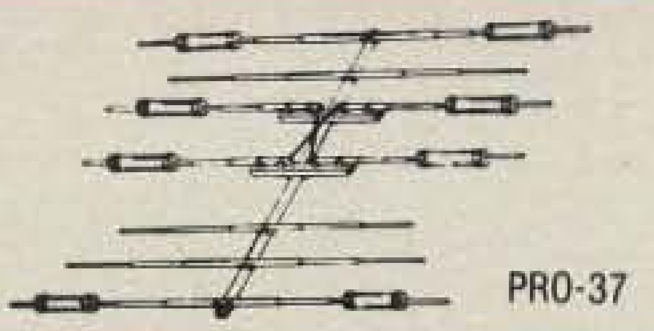


Whether you are just starting out or trying to complete the Honor Roll, Mosley offers a Full Line of Tri-Banders which will mechanically and electronically outperform the competition. For the new ham with limited space and pocket book, start with our TA-31 Jr. rotatable dipole. You can make our TA-31 Jr. into a 2 or 3 element as your needs increase.

If you start with the need to run higher power, then the TA-31 is for you. This also can be made into a 2 or 3 element beam as you expand your station.



For the ham that wants a little more performance out of a Tri-Bander but is limited in room, then our CL-33 on a 18 foot boom is the way to go. For those that want MONO BAND performance out of a Tri-Bander, want to hear better, and be louder, the CL-33 is for you.



For the ham that wants to start right at the top, the PRO-37 is the antenna that will give you king of the hill performance. It is the broadest banded, highest power, best performing Tri-Bander in our line.

Compare ours before buying any other antenna. All stainless standard, all heavy telescoping aluminum elements which means better quality and no measurement. Ease of assembly gives you a quality antenna with consistent performance. Our elements are pre-drilled so you will get the same performance as we do. All of our Tri-Banders come with a 2 year warranty.

If you are a new ham and are not familiar with MOSLEY, ask an older ham about us or call the PRESIDENT of MOSLEY. He will be glad to explain why MOSLEY is A BETTER ANTENNA.

These and other MOSLEY products are available through your favorite DEALER. Or write or call MOSLEY for the DEALER nearest you.

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- * **100 mph** wind rating.
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YOUR PRICE
$465.00
Value $555.00

By the only test that means anything . . . on the air comparison . . . Telrex Tri-Bands continue to support the fact that they are designed to out-perform all competition . . . as they have for over 3 decades. Here's why . . . Telrex uses a unique trap design employing Hi-Q 7500 V ceramic condensers, 3 optimum-tuned reflectors to provide maximum gain and true F/B Tri-Band performance.

40M346
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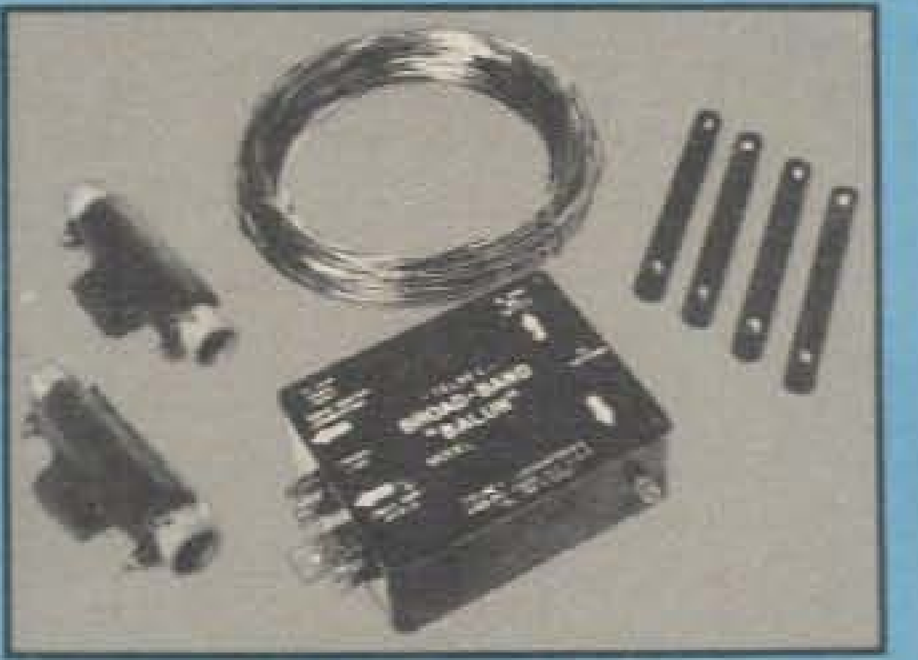
Value $2000.00

MIVD/2 frequencies
$89.50 Post Paid (U.S.)



A Telrex "Balun" fed "Inverted-Vee" kit is the ideal hi-performance inexpensive and practical to install low-frequency mono or multiple band, 52 ohm antenna system.

Better than optimum full sized Dipole performance in an antenna which can be set up within the hour, needing a minimal support structure (existing tower, house, tree, etc.). The "Inverted-Vee" produces a low-angle "Balanced" Omni-Directional pattern, which increases the signal to noise, and signal to interference ratios. Complete simplified instructions are provided. NO TUNERS NEEDED!

2MVS814 kit
$215.00

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MODEL	Description	GAIN	Value	PRICE
2M1528C	2 Meter 15 element	(17 DBD)	175.00	**145.00**
10M523	10 Meter 5 element	(13 DBD)	352.00	**295.00**
10M636	10 Meter 6 element	(14.6 DBD)	745.00	**625.00**
15M532	15 Meter 5 element	(13 DBD)	555.00	**465.00**
15M845	15 Meter 8 element	(15 DBD)	1120.00	**925.00**
20M536	20 Meter 5 element	(12 DBD)	660.00	**550.00**
20M646	20 Meter 6 element	(14 DBD)	1130.00	**945.00**
40M214	40 Meter 2 element	(5.6 DBD)	750.00	**625.00**
40M329	40 Meter 3 element	(8.3 DBD)	1145.00	**965.00**
40M346	40 Meter 3 element	(9 DBD)	2000.00	**1675.00**
TB4EC	10, 15, 20M Tri-Band	(5.5 DBD)	252.00	**215.00**
TB5ES	10, 15, 20M Tri-Band	(8.5 DBD)	408.00	**340.00**
TB6EM	10, 15, 20M Tri-Band	(10 DBD)	755.00	**580.00**

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CIRCLE 117 ON READER SERVICE CARD

1984 CQ 160 Meter Contest High-Claimed Scores

The following are early-bird high-claimed scores as of May 16, 1984. These are raw scores subject to verification. An asterisk (*) denotes multi-op entries.

C.W.

NP4A	631,772
	(K1ZM Op.)
*EA3VY	346,720
WA2SPL	318,636
G3SZA	262,472
T32AF	239,324
*LZ1KDP	237,244
YU3EF	212,790
*LZ2CJ	202,930
*UK2RDX	201,727
*YU1EXY	191,625
AA1K	190,944
VE3ABG	176,184
CT2DV	172,575
W1CF	169,353
	(N1EE Op.)
4X4NJ	164,551
*UK2PRC	151,090
K5UR	150,024
VE3DAP	149,511
K1IK	149,408
OZ1LO	146,538
PA3BFM	143,447
*WB8JBM	142,013
N9MM	132,009
*DJ1BZ/A	130,975
N4WW	125,889
*K0RF	125,652
*KS8S	124,695
*W0AIH	124,020
*UK2PCR	121,536
*DK0TU	118,456
VE1YX	117,040
*OK3KFF	116,403
*OK1KSO/P	115,804
N4UU	113,880
N5AU	111,975
	(K5ZD Op.)
K5RR	109,269
	(N5TP Op.)
OK1DXS	108,702
KJ0D/0	107,928
*K1RQ	107,692
VE3INQ	106,702
OK2MMW	105,273
*K8NZ	104,974
OK3EA	103,040
*KE9A	101,232
VE5RA	100,477
OE5KE*	100,265
*N4EHJ	100,168
W1WAI	98,021
WB7FFF	97,600
*KZ5M	96,840
UB5ZAL	96,606
G3XWZ	96,273
*KI0G	96,255
K2IGW	95,625
YV1OB	94,107
YV3AGT	92,938
W2FJ	91,950
*SP0TBC	88,918
RA9AKM	88,563
*YT3T	88,128
KK5I	86,658
K3ZZ	85,680
K7OX	85,668
G3IGW	84,702
W9UCW	83,212
OH1XX	81,432
LA2GV	81,216
*KC8KQ	81,048
K6SE	80,577
*WA0TKJ	79,235
W1WEF	78,177
LA7JO	77,904
HH2VP	76,928
*K7IDX	76,041
OK1KPU	74,762
K5NW	74,710
*UK2BCC	74,580
*NA5R	73,986
W3BGN	73,290
G3XTT	72,280
N4IN	71,632
*W0BXR	71,379
*KH6DX	71,235
VE5XU	70,896
GM3YOR	70,541
K7VIC	69,948
W3TS	69,276
EA6ET	64,623
VE7BS	64,422
G3TXF	64,107
W9YYG	62,124
*WA8RCN	60,568
W4TMR	60,552
*PA0KHS	58,999
*K5MR	58,089
*K8US	58,058
W0EJ	57,708
K9CLO	57,204
N9NB	56,007
*N4XM	55,754
K4PQL	55,610
N6ND	55,578
DK6AS	55,132
*KG9X	54,747
G4OBK	54,464
K8OQL	53,952
*UK7PAL	53,445
W3ESU	53,375
N1ACH	53,332
*KG7D	53,144
WA7OFH	51,736
UA2FCW	51,319
EI4DW	50,895
K2ITG	50,804
AK7Y	50,103
SP9DH	49,308

S.S.B.

K5UR	182,832
*VP9AD	173,329
W9ZRX	160,200
AA1K	154,710
N8ATR	129,870
*N4SF	126,084
KD4NI	117,180
VE3MFA	116,994
EA9KF	115,752
AA4S	114,390
	(NE4G Op.)
KC8JH	108,674
W3TS	101,499
*W9AZ	101,370
K0HA	101,335
W0EJ	99,076
*N7DF	97,152
W0AIH	94,208
K1NG	89,432
	(KI1G Op.)
N4UU	86,912
WU4G	86,112
YV2IF	84,332
KE9A	83,204
AA4MM	74,536
G3SZA	74,460
K2VV	73,984
KS9O	71,980
*KC5DX	71,808
*KB5DN	69,168
WA0TKJ	68,736
K6HNZ	64,764
W7EJ	62,744
*NF8C	62,496
VE6OU	62,381
W4TMR	61,432
SP3IBS	60,760
N4BNO	56,840
KF4HK	52,536
T77V	51,880
KD7SP	50,681
*K7IDX	50,476
*W8LT	50,152
N7TT	48,051
W3ICM	47,889
*K3YTL	47,277
K7VIC	46,543
KA7AUH	45,445
N7CKD	43,772
KC8P	42,598
KG4W	42,066
*WA6PVA	41,895
N4MM	40,698
KA1SR	40,284
EA3CCN	39,292
*K8US	35,325
*N4FNB	34,700
N1ACH	34,112
*KE5BC	33,935
AF1T	33,396
VE3INQ	32,208
WA5NFC	29,988
*N0DKZ	29,865
YV3AGT	29,197
*KH6DX	28,215
N4IN	27,594
N8LL	27,510
W4PZV	25,916
W2FJ	25,650
GM4KHE	24,564
VE7ERY	24,467
K0GVB/C6A	24,320
OK1KPU	23,834
	(OK1JDX Op.)
W4MAF	23,808
K0IFL	23,150
AD8C	23,144
KQ1F	23,079
W0EKS	20,852
KB6JK	20,328
K8OQL	19,872
XE1HHA	17,464

Note: Queries pertaining to the 160 Meter Contest should be sent to Don McClenon, N4IN, 3075 Florida Ave., Melbourne, FL 32901.

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- Baud rates to 1200 ASCII & BAUDOT
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Kit $ 99.95
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- Single shift RTTY terminal unit.
- Xtal AFSK, FSK, active-filters.

Kit $189.95
wired $289.95

TU-470
- Full featured RTTY to 300 baud plus CW terminal unit.
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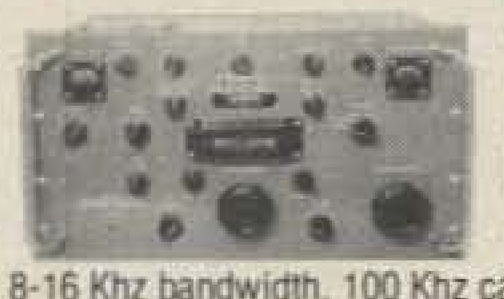

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CIRCLE 64 ON READER SERVICE CARD

Propagation

a monthly feature by
GEORGE JACOBS, W3ASK

THE SCIENCE OF PREDICTING RADIO CONDITIONS

Oliver Perry Ferrell
1921-1984

It was with great personal sadness that I learned of Perry Ferrell's untimely and needless death on April 22. Perry was the innocent victim of an auto accident in New York State, which reportedly was caused by a driver who had apparently fallen asleep, and was driving out of control on the wrong side of the road when he struck Perry's car. Perry was pronounced dead at the scene, and his wife, Jeanie, was injured.

I had known Perry Ferrell since early 1946, when he joined the *CQ* staff as Assistant Editor. Perry and I shared much in common—our love of radio, our interests in wave propagation, and our desire to write.

Perry had the foresight to recognize amateur radio's need for simplified radio propagation predictions, and he was the author of the first such column on this subject which appeared in the June 1946 issue of *CQ*. I was in University at the time, and his column was the first I would read each month in those early issues of *CQ*. Perry was also responsible for bringing amateur radio into the professional field of propagation research. Through his leadership, and with the support of the U.S. Air Force, amateur radio was enlisted to help solve the riddles of sporadic-*E* propagation. Much of what we now know about this medium of wave propagation resulted from Perry's efforts.

I felt honored when during late 1950 Perry asked me if I would take over as Propagation Editor for *CQ*. I wrote several dummy columns before the first one appeared in the March 1951 issue. Perry patiently and constructively edited those dummy columns, and I learned much about writing from him.

I had remained friends with Perry and his lovely wife, Jeanie, all of these years. I watched happily as his pet idea for a specialized mail-order service catering to the needs of radio amateurs and shortwave listeners grew into one of the finest in the field.

Perry Ferrell's key is now silent. Amateur radio has lost a leader, I have lost a friend to whom I am much indebted, and the world has lost a wonderful person.

I hope that this column will remain, albeit in a small way, a continuing tribute to Oliver Perry Ferrell, without whose genius it would never have been possible.

LAST MINUTE FORECAST

Day-to-Day Conditions Expected for August 1984

	Expected Signal Quality			
Propagation Index	**(4)**	**(3)**	**(2)**	**(1)**
Above Normal: 6, 17, 23, 25	**A**	**A**	**B**	**C**
High Normal: 1-2, 5, 7, 15-16, 18, 20, 24, 28-29	**A**	**B**	**C**	**C-D**
Low Normal: 3-4, 8-9, 12-14, 19, 21-22, 26-27, 30	**A-B**	**B-C**	**C-D**	**D-E**
Below Normal: 11, 31	**B-C**	**C-D**	**D-E**	**E**
Disturbed: 10	**C-E**	**D-E**	**E**	**E**

***Where expected signal quality is:* A—Excellent opening, exceptionally strong, steady signals greater than S9.**

B—Good opening, moderately strong signals varying between S6 and S9, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S6, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S3, and with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. **Find *propagation index* associated with particular band opening from Propagation Charts appearing on the following pages.**
2. **With the *propagation index*, use the above table to find the expected signal quality associated with the band opening for any day of the month. For example, an opening shown in the charts with a *propagation index* of 3 will be good (B) on August 1st and 2nd, good-to-fair (B-C) on the 3rd and 4th, good (B) on the 5th, excellent (A) on the 6th etc.**

According to the latest available monthly mean sunspot number, the present sunspot count remains stalled at the 68 level.

The Royal Observatory of Belgium reports a monthly mean sunspot level of 68.6 for April 1984. Daily values ranged from a high of 124 on the 26th to a low of 12 on the 10th. This results in a *smoothed sunspot number* of 68.1 centered on October 1983. The progress of a solar cycle is measured by the smoothed sunspot number. The present cycle has held between levels of 66 and 68 from July through October 1983. A smoothed sunspot number of approximately 50 is forecast for August 1984, but this could be higher if the present plateau should continue.

August DX Conditions

August and early September are perhaps the most difficult period of the year for which to make a shortwave propagation forecast. On many days typical summertime conditions will prevail, and the bands will sound much as they did during July. On other days, particularly as September approaches, conditions will begin to conform more to a winter pattern of higher daytime and lower nighttime usable frequencies. Since this is a period of transition, this month's DX Propagation Charts cover only a *one month* period, rather than the usual two month span. Short-Skip Charts for use during August appeared in last month's column.

Fairly frequent *10* meter openings are expected during the daylight hours in August towards Central and South America, Africa, and the South Pacific areas. By the end of the month some openings should also be possible to Europe and the Far East. These east-west openings should increase considerably during September.

Excellent daytime DX openings are forecast for *15* meters to Latin America, Africa, and the South Pacific areas. Some east-west openings to Europe and the Far East should also be possible, and these should increase considerably as September approaches. Exceptionally strong signal levels are expected during many openings this month, and *15* meters should be the best band for DX to many areas of the world from shortly after sunrise through the late afternoon hours.

Excellent world-wide propagation conditions are forecast for *20* meters during August. Peak conditions should occur, often with exceptionally strong signal levels, for a few hours after sunrise and again during the late afternoon and early evening hours. To many southern and tropical areas, the band may remain open throughout much of the darkness period as well. As September approaches, the band will tend to close earlier than it did during June and July.

Static levels are expected to decrease considerably by mid-August, with a noticeable improvement in *40* meter DX conditions during the hours of darkness and the sunrise period. Fairly good *80* meter DX openings are also forecast for the nighttime hours, with conditions expected to peak just as the sun begins to rise on the "light" side of the path. By late August some *160* meter DX openings may also be possible during this time period.

Short-Skip Conditions

For openings over distances ranging between 50 and 250 miles, use *80* meters during the day and *160* meters at night. Between 250 and 750 miles the best bands should be *40* meters during the day and *80* meters during the hours of darkness. For openings between 750 and 1300 miles the best band should be *20*

11307 Clara Street, Silver Spring, MD 20902

HOW TO USE THE DX PROPAGATION CHARTS

1. Use Chart approprate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8 KP4, KG4 and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9 and 0 areas; the Western USA Chart in the 6 and 7 areas, and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 Meters) for a particular DX region, as shown in the left-hand column of the Charts. An * indicates the best time to listen for 160 meter openings.

3. The *propagation index* is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of *days* during the month on which the opening is expected to take place as follows:

(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual *dates* on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

4. Times shown in the Charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. Appropriate *daylight* time is used, *not* GMT. To convert to GMT, add to the times shown in the appropriate chart 7 hours in PDT Zone, 6 hours in MDT Zone, 5 hours in CDT Zone, and 4 hours in EDT Zone. For example, 14 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 03 GMT, etc.

5. The charts are based upon a transmitted power of 250 watts c.w., or 1 kw, p.e.p. on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, and a half-wavelength above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 dB gain above these reference levels, the *propagation index* will increase by one level for each 10 dB loss, it will lower by one level.

6. Propagation data contained in the Charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Dept of Commerce, Boulder, Colorado, 80302.

August 15 to September 15, 1984
Time Zone: EDT (24-Hour Time)
EASTERN USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Central Europe & North Africa	09-15 (1)	08-10 (1) 10-15 (2) 15-17 (1)	05-06 (1) 06-07 (2) 07-10 (3) 10-11 (2) 11-13 (1) 13-14 (2) 14-16 (3) 16-17 (4) 17-18 (3) 18-19 (2) 19-21 (1)	19-21 (1) 21-23 (2) 23-01 (3) 01-02 (2) 02-03 (1) 20-21 (1)* 21-00 (2)* 00-02 (1)*
Northern Europe & European USSR	09-13 (1)	08-09 (1) 09-14 (2) 14-16 (1)	05-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-17 (3) 17-19 (2) 19-21 (1)	19-21 (1) 21-00 (2) 00-02 (1) 20-21 (1)* 21-00 (2)* 00-01 (1)*
Eastern Mediterranean & Middle East	11-14 (1)	08-09 (1) 09-16 (2) 16-17 (1)	07-09 (2) 09-14 (1) 14-16 (2) 16-19 (3) 19-22 (2) 22-01 (1)	19-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
Western Africa	11-14 (1) 14-16 (2) 16-17 (1)	07-09 (1) 09-14 (2) 14-17 (3) 17-18 (2) 18-19 (1)	13-15 (1) 15-17 (2) 17-19 (3) 19-23 (4) 23-02 (3) 02-06 (2) 06-09 (1)	20-23 (1) 23-02 (2) 02-03 (1) 21-02 (1)*
Eastern & Central Africa	13-16 (1)	10-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	13-15 (1) 15-17 (2) 17-20 (3) 20-22 (2) 22-00 (1)	20-02 (1) 21-01 (1)*
Southern Africa	10-11 (1) 11-13 (2) 13-14 (1)	09-11 (1) 11-13 (2) 13-14 (3) 14-16 (4) 16-17 (2) 17-18 (1)	08-15 (1) 15-17 (2) 17-21 (3) 21-22 (2) 22-00 (1) 00-02 (2) 02-03 (1)	20-22 (1) 22-01 (2) 01-03 (1) 21-02 (1)*
Central & South Asia	*Nil*	09-12 (1) 20-22 (1)	07-08 (1) 08-10 (2) 10-12 (1) 19-20 (1) 20-22 (2) 22-00 (1)	05-07 (1) 19-21 (1)
Southeast Asia	*Nil*	08-10 (1) 10-12 (2) 12-14 (1) 18-19 (1) 19-21 (2) 21-22 (1)	06-08 (1) 08-10 (2) 10-11 (1) 19-22 (1) 22-00 (2) 00-01 (1)	*Nil*
Far East	*Nil*	09-11 (1) 18-20 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-13 (1) 18-20 (1) 20-22 (2) 22-00 (1)	05-06 (1) 06-07 (2) 07-08 (1) 06-07 (1)*
South Pacific & New Zealand	11-15 (1) 15-18 (2) 18-20 (1)	09-15 (1) 15-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	12-20 (1) 20-22 (2) 22-02 (3) 02-04 (2) 04-07 (1) 07-09 (2) 09-12 (1)	01-02 (1) 02-03 (2) 03-06 (3) 06-07 (2) 07-09 (1) 02-04 (1)* 04-07 (2)* 07-08 (1)*
Australasia	16-17 (1) 17-19 (2) 19-21 (1)	09-11 (1) 16-18 (1) 18-21 (2) 21-22 (1)	07-10 (2) 10-16 (1) 16-18 (2) 18-22 (1) 22-00 (2) 00-02 (1)	03-04 (1) 04-07 (2) 07-08 (1) 04-05 (1)* 05-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	09-11 (1) 11-13 (2) 13-16 (3) 16-18 (2) 18-19 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-14 (4) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	07-08 (3) 08-10 (4) 10-12 (3) 12-15 (2) 15-18 (3) 18-20 (4) 20-02 (3) 02-04 (2) 04-06 (1) 06-07 (2)	19-20 (1) 20-21 (2) 21-03 (4) 03-05 (3) 05-06 (2) 06-08 (1) 20-00 (1)* 00-05 (2)* 05-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	09-12 (1) 12-14 (2) 14-17 (3) 17-18 (2) 18-19 (1)	07-08 (1) 08-11 (2) 11-14 (1) 14-16 (2) 16-17 (3) 17-19 (4) 19-20 (3) 20-21 (1)	13-16 (1) 16-18 (2) 18-19 (3) 19-22 (4) 22-02 (3) 02-03 (2) 03-06 (1) 06-07 (2) 07-09 (3) 09-10 (2) 10-12 (1)	20-23 (1) 23-05 (2) 05-07 (1) 03-06 (1)*
McMurdo Sound, Antarctica	*Nil*	14-16 (1) 16-18 (2) 18-19 (1)	18-20 (1) 20-21 (2) 21-00 (3) 00-02 (2) 02-07 (1) 07-09 (2) 09-10 (1)	01-05 (1)

Time Zones: CDT & MDT (24-Hour Time)
CENTRAL USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Southern Europe & North Africa	09-14 (1)	09-11 (1) 11-14 (2) 14-16 (1)	05-07 (1) 07-09 (2) 09-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-00 (1)	19-22 (1) 22-01 (2) 01-02 (1) 20-01 (1)*
Northern & Central Europe & European USSR	08-12 (1)	11-16 (1)	05-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-16 (3) 16-18 (2) 18-20 (1)	19-20 (1) 20-00 (2) 00-01 (1) 20-00 (1)*
Eastern Mediterranean & Middle East	*Nil*	10-11 (1) 11-13 (2) 13-15 (1)	06-08 (1) 08-10 (2) 10-15 (1) 15-16 (2) 16-18 (3) 18-19 (2) 19-22 (1)	19-00 (1) 20-23 (1)*
Western Africa	10-12 (1) 12-16 (2) 16-17 (1)	07-10 (1) 10-13 (2) 13-17 (3) 17-19 (2) 19-20 (1)	13-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-00 (3) 00-01 (2) 01-08 (1)	20-23 (1) 23-01 (2) 01-02 (1) 21-00 (1)*
Eastern & Central Africa	13-15 (1)	11-13 (1) 13-17 (2) 17-18 (1)	13-15 (1) 15-17 (2) 17-22 (3) 22-00 (2) 00-02 (1)	20-00 (1) 21-23 (1)*
Southern Africa	11-13 (1)	08-10 (1) 10-12 (2) 12-16 (3) 16-17 (2) 17-18 (1)	06-09 (1) 13-15 (1) 15-18 (3) 18-20 (2) 20-22 (1) 22-00 (2) 00-01 (1)	19-21 (1) 21-00 (2) 00-01 (1) 21-00 (1)*
Central & South Asia	*Nil*	09-11 (1) 18-19 (1) 19-21 (2) 21-22 (1)	07-08 (1) 08-10 (2) 10-11 (1) 17-19 (1) 19-21 (2) 21-23 (1)	06-08 (1) 19-21 (1)
Southeast Asia	*Nil*	10-12 (1) 17-18 (1) 18-20 (2) 20-21 (1)	07-08 (1) 08-10 (2) 10-13 (1) 19-21 (1) 21-23 (2) 23-01 (1)	06-08 (1)
Far East	*Nil*	09-11 (1) 15-16 (1) 16-18 (2) 18-20 (1)	19-22 (1) 22-00 (2) 00-02 (1) 07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-15 (1)	03-06 (1) 06-07 (2) 07-08 (1) 05-07 (1)*
South Pacific & New Zealand	09-15 (1) 15-17 (2) 17-19 (3) 19-20 (1)	09-13 (1) 13-17 (2) 17-18 (3) 18-20 (4) 20-21 (3) 21-22 (2) 22-23 (1)	08-10 (3) 10-13 (2) 13-18 (1) 18-20 (2) 20-23 (3) 23-03 (4) 03-05 (3) 05-08 (2)	00-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1) 01-03 (1)* 03-06 (2)* 06-07 (1)*
Australasia	09-11 (1) 14-16 (1) 16-19 (2) 19-20 (1)	09-11 (1) 15-16 (1) 16-18 (2) 18-21 (3) 21-22 (2) 22-23 (1)	08-10 (3) 10-13 (2) 13-20 (1) 20-22 (2) 22-23 (3) 23-01 (4) 01-05 (3) 05-08 (2)	02-04 (1) 04-05 (2) 05-06 (3) 06-07 (2) 07-08 (1) 03-04 (1)* 04-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South	09-11 (1) 11-13 (2) 13-15 (3) 15-16 (2) 16-17 (1)	07-08 (1) 08-10 (2) 10-13 (3) 13-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	08-10 (4) 10-12 (3) 12-16 (2) 16-18 (3) 18-22 (4) 22-01 (3) 01-05 (2) 05-08 (3)	19-20 (1) 20-21 (2) 21-03 (4) 03-05 (3) 05-06 (2) 06-07 (1) 20-23 (1)* 23-05 (2)* 05-06 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	08-11 (1) 11-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	07-08 (1) 08-10 (2) 10-13 (1) 13-15 (2) 15-16 (3) 16-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	12-16 (1) 16-17 (2) 17-19 (3) 19-22 (4) 22-02 (3) 02-04 (2) 04-07 (1) 07-09 (2) 09-10 (1)	20-22 (1) 22-05 (2) 05-07 (1) 02-05 (1)*
McMurdo Sound, Antarctica	*Nil*	13-15 (1) 15-17 (2) 17-20 (1)	17-19 (1) 19-21 (2) 21-01 (3) 01-03 (2) 03-07 (1) 07-09 (2) 09-10 (1)	01-06 (1)

TIME ZONE: PDT (24-Hour Time)
WESTERN USA TO:

	10 Meters	15 Meters	20 Meters	40/80 Meters
Western & Southern Europe & North Africa	*Nil*	09-11 (1) 11-13 (2) 13-15 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-13 (2) 13-14 (3) 14-15 (2) 15-18 (1) 22-23 (1) 23-01 (2) 01-02 (1)	20-21 (1) 21-23 (2) 23-00 (1) 22-23 (1)*
Central & Northern Europe & European USSR	*Nil*	09-11 (1)	06-07 (1) 07-09 (2) 09-12 (1) 12-15 (2) 15-17 (1) 22-00 (1)	18-20 (1) 20-22 (2) 22-23 (1) 21-22 (1)*

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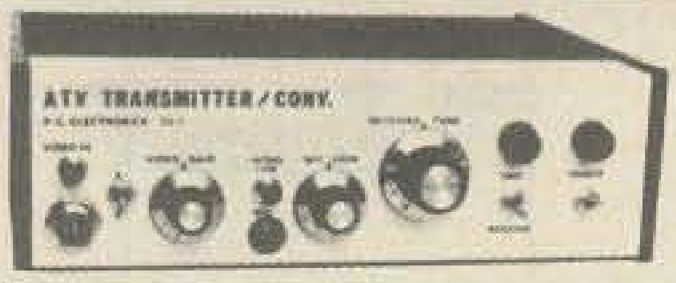

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CIRCLE 77 ON READER SERVICE CARD

Eastern Mediterranean & Middle East	*Nil*	08-09 (1) 09-11 (2) 11-12 (1)	07-08 (1) 08-10 (2) 10-13 (1) 13-15 (2) 15-17 (1) 19-20 (1) 20-22 (2) 22-23 (1)	20-22 (1)
Western & Central Africa	13-16 (1)	08-11 (1) 11-13 (2) 13-15 (3) 15-17 (2) 17-18 (1)	13-15 (1) 15-17 (2) 17-18 (3) 18-19 (4) 19-20 (3) 20-00 (2) 00-07 (1) 07-09 (2) 09-10 (1)	21-00 (1)
Eastern Africa	*Nil*	09-13 (1) 13-16 (2) 16-18 (1)	13-15 (1) 15-18 (2) 18-19 (3) 19-21 (2) 21-22 (1)	20-22 (1)
Southern Africa	10-13 (1)	07-09 (1) 09-11 (2) 11-13 (3) 13-14 (2) 14-15 (1)	07-09 (1) 13-15 (1) 15-16 (2) 16-18 (3) 18-19 (2) 19-22 (1) 22-23 (3) 23-00 (1)	19-20 (1) 20-22 (2) 22-23 (1) 20-22 (1)*
Central & South Asia	*Nil*	09-11 (1) 17-19 (1) 19-21 (2) 21-22 (1)	07-08 (1) 08-10 (2) 10-12 (1) 18-20 (1) 20-22 (2) 22-23 (1)	06-08 (1)
Southeast Asia	16-19 (1)	09-11 (1) 15-17 (1) 17-20 (2) 20-21 (1)	21-01 (1) 01-03 (2) 03-04 (3) 04-07 (2) 07-09 (3) 09-10 (2) 10-12 (1) 19-21 (1)	03-07 (1)
Far East	15-18 (1)	09-11 (1) 14-15 (1) 15-17 (2) 17-19 (3) 19-20 (2) 20-22 (1)	21-23 (2) 23-01 (3) 01-02 (2) 02-07 (1) 07-08 (2) 08-10 (4) 10-11 (3) 11-12 (2) 12-14 (1)	02-03 (1) 03-05 (2) 05-07 (3) 07-08 (1) 02-05 (1)* 05-06 (2)* 06-07 (1)*
South Pacific & New Zealand	09-15 (1) 15-16 (2) 16-19 (3) 19-20 (2) 20-21 (1)	09-13 (1) 13-17 (2) 17-18 (3) 18-20 (4) 20-21 (3) 21-22 (2) 22-00 (1)	05-09 (2) 09-11 (3) 11-13 (2) 13-17 (1) 17-19 (2) 19-22 (3) 22-01 (4) 01-05 (3)	22-23 (1) 23-04 (3) 04-06 (4) 06-07 (3) 07-08 (1) 23-01 (1)* 01-03 (2)* 03-05 (3)* 05-06 (2)* 06-07 (1)*
Australasia	09-14 (1) 14-18 (2) 18-20 (1)	09-11 (1) 14-18 (1) 18-19 (2) 19-21 (3) 21-22 (2) 22-00 (1)	13-20 (1) 20-22 (2) 22-23 (3) 23-02 (4) 02-05 (3) 05-08 (2) 08-10 (3) 10-13 (2)	01-02 (1) 02-03 (2) 03-06 (3) 06-07 (2) 07-08 (1) 02-04 (1)* 04-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	09-11 (1) 11-16 (2) 16-17 (1)	07-08 (1) 08-10 (3) 10-12 (2) 12-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-20 (4) 20-00 (3) 00-05 (2) 05-06 (3)	19-20 (1) 20-21 (3) 21-04 (4) 04-05 (2) 05-06 (1) 20-22 (1)* 22-03 (2)* 03-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	08-11 (1) 11-14 (2) 14-15 (3) 15-16 (2) 16-18 (1)	06-07 (1) 07-09 (2) 09-13 (1) 13-14 (2) 14-15 (3) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	13-15 (1) 15-17 (2) 17-19 (3) 19-21 (4) 21-23 (3) 23-00 (2) 00-07 (1) 07-09 (2) 09-11 (1)	20-23 (1) 23-04 (2) 04-05 (1) 00-04 (1)*
McMurdo Sound, Antarctica	*Nil*	13-17 (1) 17-19 (2) 19-21 (1)	09-11 (1) 17-19 (1) 19-21 (2) 21-00 (3) 00-02 (2) 02-04 (1)	23-03 (1) 03-05 (2) 05-07 (1)

**Indicates best time for 80 meter openings. Openings on 160 meters are also likely to occur during those times when 80 meter openings are shown with a propagation index of (2) or higher.*

meters during the day, with some fairly good openings also possible on 15 meters. From sundown to midnight try 40 meters, and from midnight to sunrise conditions should be best on 80 meters. Between 1300 and 2300 miles the best daytime band should be 20 meters, with some good openings also possible on 15 meters. Try 40 meters during the hours of darkness.

V.H.F. Ionospheric Openings

While sporadic-*E* propagation is expected to taper off considerably by mid-August, some 6 meter openings should still be possible over distances of approximately 750 to 1300 miles. During periods of intense and widespread sporadic-*E* ionization, two-hop openings may be possible considerably beyond this range. Check the 2 meter band for an occasional sporadic-*E* type opening between approximately 1200 and 1400 miles. While these types of short-skip openings can take place at any time, as the name implies, during the late summer there is a tendency for them to peak between 8 a.m. and noon and again between 6 and 9 p.m. local daylight time. The occurrence of sporadic-*E* openings should decrease considerably by mid-September.

Trans-equatorial (TE) propagation conditions on 6 meters should begin to improve during August, and some openings may be possible by the end of the month. The best time for these openings is between 8 and 11 p.m. local daylight time. This type of propagation considerably favors openings from the southern tier states into deep South America, but an occasional opening should also be possible from more northern states.

The *Perseids*, one of this year's major meteor showers, is expected to take place between August 10th and 14th. It should peak on August 12 with an expected count of about 50 meteors an hour. Ionization produced by this meteor shower, especially during the period of maximum intensity, is expected to make possible frequent meteor-scatter-type openings on the 6 and 2 meter bands up to distances of several hundred miles.

Although August usually is not a very good month for auroral-type scatter propagation on the v.h.f. bands, some openings may be possible. Auroras during August are most likely to occur coincident with Below or Disturbed conditions on the h.f. bands. Check the Last-Minute Forecast at the beginning of this column for those days during the month that are expected to be in these categories. Auroral-scatter openings can range from a few hundred miles up to about a thousand miles, and they are usually characterized by very rapid flutter fading and Doppler shift on s.s.b. signals.

73, George, W3ASK

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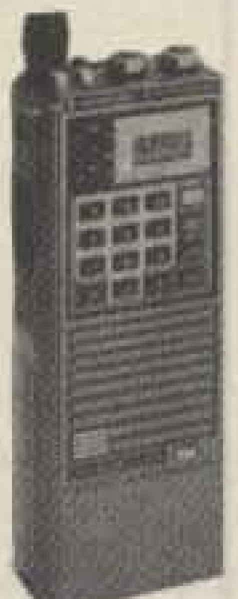

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Contest Calendar

a monthly feature by
FRANK ANZALONE, W1WY

NEWS/VIEWS OF ON-THE-AIR COMPETITION

Announcing a New CQ WW DX Contest Category: Team Contesting

1. A team consists of any five radio amateurs operating in the single operator category.

2. A person can be on only one team per mode.

3. A team **must operate** from two continents.

4. Competing on a team will not prevent any team member from submitting his personal score for a radio club.

5. A team score will be the sum of all the team member scores.

6. S.S.B. and C.W. teams are totally separate. That is, a member of an S.S.B. team can be on a totally different C.W. team.

7. A list of a team's members must be received by October 15 for S.S.B. and November 15 for C.W. Send the list to *CQ*, Att: Team Contest, 76 North Broadway, Hicksville, NY 11801 U.S.A.

8. Awards will be given to the top five teams.

9. A list of a team's members scores plus the total team score must be submitted to *CQ* by the normal contest log deadlines.

As indicated in the June column, there will be a number of changes and deletions in the *CQ* World-Wide DX Contest trophy list for the contest this fall. Jim Neiger, N6TJ, has already advised us that he will no longer be sponsoring the Carib./C.A. awards. The British group has also terminated the G2LB, 14 MHz C.W. award for Europe. Thanks to N6TJ and G3KFM who made these awards available.

In addition, there will be other deletions, not by choice of the donors, but for other obvious reasons. We cannot continue to make excuses for sponsors who have been lax in meeting their obligations. Many new and responsible voluntary sponsors have come forward, filling the void in the vacated spots and also creating awards in new areas. It should be worth your while to study the new list in next month's announcement of the 1984 rules. Also check next month's contest rules for where to send your logs, as there have been some address changes.

I have been called to task for some of the errors in recent contest announcements, but fortunately I usually cover my mistakes by making questionable announcements "not official." These errors could be avoided if the monthly deadlines were observed. Announcements for events in November must be received no later than August 15th, and September 15 for December activities.

73 for this time, Frank, W1WY

14 Sherwood Road, Stamford, CT 06905

Calendar of Events

	Aug.	4-5	Romanian DX Contest
	Aug.	4-5	"Wild Bunch" 160 SSB
*	Aug.	5-6	Illinois QSO Party
	Aug.	11-12	DARC European CW Contest
	Aug.	11-13	New Jersey QSO Party
	Aug.	18-19	SARTG RTTY Contest
*	Aug.	18-19	SEANET SSB Contest
	Aug.	18-19	Alaska QSO Party
†	Aug.	25-26	All Asian CW Contest
	Aug.	25-26	Alabama QSO Party
	Aug.	25-26	Occupation Contest
	Sep.	1	DARC Corona 10 Meter RTTY
**	Sep.	2	Bulgarian CW Contest
	Sep.	5-6	YLRL "Howdy Days"
	Sep.	8-9	DARC European SSB Contest
	Sep.	15-16	Ohio QSO Party
	Sept.	15-16	SAC C.W. Contest
	Sep.	15-17	Washington State QSO Party
	Sep.	15-17	Kansas State QSO Party
	Sep.	21-23	Maine QSO Party
	Sep.	22-23	SAC S.S.B. Contest
	Sep.	29-30	Delta QSO Party
	Oct.	13-14	Columbus Day Contest
	Oct.	13-14	Pennsylvania QSO Party
	Oct.	17-18	YLRL Anniv. CW Party
	Oct.	20-21	Boy Scouts Jamboree
	Oct.	**27-28**	**CQ WW DX S.S.B. Contest**
	Oc.31	-Nv.1	YLRL Anniv. Phone Party
	Nov.	10-11	DARC Euro. RTTY Contest
	Nov.	17-18	QRP Club QSO Party
	Nov.	**24-25**	**CQ WW DX C.W. Contest**

**Covered last month.*
***Not official.*
†See June Calendar.

Romanian DX Contest

2000Z Sat. to 1600Z Sun., Aug. 4–5

This is the first time we have heard from the Romanian Amateur Radio Federation in a couple of years. This is the complete set of new rules. Operation will be on all 5 bands, 3.5 through 28 MHz, c.w. and s.s.b., observing the IARU band plan.

Classes: Single operator, single and all band, and multi-operator all band (club stations).

Exchange: RS(T) and ITU zone. YO stations will also include 2 letters identifying their county (41 counties).

Scoring: QSOs with YO stations are worth 8 points; with stations outside own continent 4 points; with stations within own continent 2 points. (Own country has no value.)

Multiplier: Sum of ITU zones and YO counties worked on each band.

Final Score: Total QSO points from all bands (or single band) times the sum of the multipliers worked on each band.

Awards: The top scorer in each class in each country will receive the title "International Short-Wave Champion of Romania" and will receive a crystal cup.

Stations contacting at least 50 different stations, a minimum of which are Romanian, will receive an award. The same YO station worked on different bands will count separately (maximum of 5).

The continental winner, regardless of class section, will become an honorary member of the YO DX Club.

Use a separate log sheet for each band, indicate the multiplier in a separate column only the first time it is worked, and be sure to cross out any duplicate contacts. A summary sheet showing the scoring, etc., and the usual signed declaration that all rules and regulations have been observed is also requested.

Mailing deadline for all entries is September 4th to: Romanian Amateur Radio Federation, P.O. Box 05 - 50, R-76100 Bucharest, Romania. *(See June CQ Contest Calendar for list of ITU Zones.—ed.)*

"Wild Bunch" 160 SSB Contest

0000Z Sat. to 2359Z Sun., Aug. 4–5

Anyone who schedules a 160 meter contest in midsummer has got to be wild. There are 30 charter members in this club, including some overseas stations, so maybe they've got something going. Give it a try.

Exchange: Signal report and QTH; state, VE province, or country. Charter members include their number.

Scoring: Each QSO is worth 10 points. Multiply that total by the number of states, provinces, and countries worked, including the bonus multiplier.

The bonus multiplier is as follows: one for each charter member worked, and an additional 20 if you work 15 charter members. Contact the club station VE7WCB (s.s.b. or c.w.) and earn an additional 10 points.

Awards: Certificates to the winners in each state, VE province, and DX country. A plaque to the "Top Banana" in the contest, and a special award if you work all 30 charter members. Single operator only.

To join the Wild Bunch, U.S. stations must work at least 10 charter members (DX stations must work at least 5) between June 1st and September 1st. Double the above figures if in the period between September 1st and June 1st. A

$2.00 fee is required for membership application. Send it to: Bob LeBlanc, KA1FDS, Unity Road, Benton, RFD 1, Box 800, Clinton, ME 04927.

Contest logs go to: R.J. Koziomkowski, 5 Watson Drive, Portsmouth, RI 02871. Mailing deadline is September 6th.

European DX Contest

C.W.: Aug. 11–12 Phone: Sept. 8–9
Starts: 0000 GMT Saturday
Ends: 2400 GMT Sunday

This is the 29th annual contest sponsored by the DARC. The activity will be between European countries and the rest of the world on all bands 3.5–28 MHz.

Following are updated rules, including two new features. U.S. states will now count as a multiplier, and QSO dupe sheets will now be required for each band on which 200 or more contacts are made.

Only 36 hours out of the 48-hour contest period may be used by single-operator stations. The 12 hour off periods may be taken in one, but not more than three, periods anytime in the contest and must be indicated in the log.

Classes: Single operator and multi-operator single transmitter, both all bands. Multi-operator stations are allowed to change bands one time only within a 15 minute period. A quick band change and return is allowed to work a new multiplier.

Exchange: RS(T) plus a QSO number starting with 001. In addition, W/K stations will include their state (i.e., 599011 MA).

Scoring: One point per QSO and one point for each QTC reported.

Multiplier: The multiplier for non-European stations is determined by the number of European countries worked on each band (WAE list). Europeans will use the ARRL DXCC list. In addition, each call area of the following countries will be considered a multiplier: JA, PY, VE/VO, VK, ZL, ZS, and UA90. *Each W/K state will also be considered a multiplier.*

The multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14/21/28 MHz by 2.

Final Score: Total QSO points, plus QTC points, times the sum total multiplier from all bands.

QTC Traffic: Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that took place earlier in the contest and was later sent back to a European station. It can only be sent from a non-European station back to a European. The general idea is that after a number of Europeans have been worked, a list of these stations can be reported back during a QSO with another station. An additional one point credit can be claimed for each station reported.

A QTC contains the time, call, and QSO number of the station being reported (i.e., 1300/DL2DN/134, which means that at 1300Z you worked DL2DN and received #134).

A QSO can be reported only once and not back to the originating station.

A maximum of 10 QTCs to a station is allowed. The same station may be worked several times to complete this quota. Only the original contact, however, has QSO value.

Keep a uniform list of QTCs sent; (3/7 indicates that this is the 3rd series of QTCs sent and that 7 QSOs are being reported).

Awards: Certificates to the top scorers in each class in each country and areas listed in the multiplier. Continental leaders and stations having at least half the score of the continental leader will also be honored.

Disqualification: Violation of the rules of the contest, unsportsmanlike conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification.

Logs: It is suggested that you use the official DARC or equivalent forms. Figure 40 contacts to the page, and use a separate sheet for each band. A large-size s.a.e. and IRCs will get you a supply.

All entrants are now required to submit cross-check dupe sheets for each band with 200 or more QSOs. A penalty of three contacts will be deducted for each duplicate QSO that is removed by the committee.

Mailing deadline is September 15th for C.W. and October 15th for Phone. All entries go to: The WAEDC Contest Commit-

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220C040-2 More power for the 220 simplex operator. A full 40 watt output with 2 watt input. Usable from 0.5 watt input (10 watt output) to 5 watt input (50 watt output). Guaranteed bandwidth 218-227 MHz. Maximum DC current: 10 amps at 40 watt output and 13.8 Vdc. Dimensions: 3x7.5x4.5 (HxWxD) inches. Weight 2.5 lb. I/O connectors: SO-239 (50 ohm UHF). Automatic carrier operated antenna switching. Reverse polarity protection. Front panel on-off switch for "barefoot" operation. VSWR protected. CONTINUOUS DUTY. Reg. $139.95

450C030-2 A solid 30 watt output from your UHF hand-held! Usable 0.5 watt input (4 watt output) to 4 watt input (40 watt output). Guaranteed bandwidth: 420-470 MHz! Maximum DC current: 7 amps at 30 watt output and 13.8 Vdc. Dimensions: 3x7.5x4.5 (HxWxD) inches. Weight: 2.5 lb. I/O connectors: SO-239 (50 ohm UHF). Automatic carrier operated antenna switching. Reverse polarity protected. Front panel on-off switch for "barefoot" operation. VSWR protected. CONTINUOUS DUTY RATED Reg. $139.95

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SARTG RTTY Contest

Three Periods GMT
0000–0800 & 1600–2400 Sat., Aug. 18
0800–1600 Sun., Aug. 19

This is the 14th annual contest sponsored by the Scandinavian Amateur Radio Teletype Group. Use all bands 3.5 through 28 MHz. The same station may be worked on each band for QSO and multiplier credit.

Classes: Single operator, multi-operator single transmitter, and s.w.l.

Exchange: QSO no., signal report.

Points: QSOs with own country, 5 points. With other countries on same continent, 10 points. With other continents, 15 points. The U.S., Canada, and Australia call areas count as separate countries for scoring.

Multiplier: Each DXCC country and each W/K, VE/VO, and VK call area. A multiplier will not be considered unless the claimed station appears in at least five logs, or a log is received from that station.

Final Score: Sum of QSO points from all bands times the sum of the multiplier from each band.

S.w.l.'s use same scoring but based on sum of stations and messages copied.

Awards: Certificates to the top-scoring stations in each class in each country and each call area of the U.S., Canada, and Australia.

Use a separate sheet for each band, and include a summary sheet showing the scoring, comments, and other essential information, and your name and address in block letters.

Logs must be received by October 10th and go to: SARTG Contest Manager, C.J. Jensen, OZ2CJ, P.O. Box 717, DK 8600 Silkeborg, Denmark.

New Jersey QSO Party

2000Z Sat. to 0700Z Sun. Aug. 11–12
1300Z Sun. to 0200Z Mon. Aug. 12–13

This is the 25th annual party sponsored by the Englewood ARA. Phone and c.w. are part of the same contest, the same station may be worked on each band and mode, and NJ stations may contact in-state stations for QSO and multiplier credit.

Exchange: QSO no., RS(T), and QTH. County for NJ, ARRL section or country for others.

Scoring: NJ stations score 1 point for W/K and VE/VO contacts, and 3 points for DX. Multiply total by ARRL sections worked (maximum of 74). KP4, KL7, KH6, etc., are 3-point contacts and section multipliers.

Out-of-state stations multiply total NJ QSOs by number of NJ counties worked (maximum of 21).

Frequencies: 1810, 3535, 3900, 7035, 7135, 7235, 14035, 14280, 21100, 21355, 28100, 28610, 50–50.5, and 144–146. Try phone on even hours, 15 on odd hours, and 160 at 0500 UTC.

Awards: Certificates to the top scorers in each NJ county, ARRL section, and DX country. Second-place awards if four or more logs are received from that section. Also Novice and Tech., and mobile awards.

Use UTC time, indicate the multiplier only the first time it is worked, include a QSO check sheet, and include a summary sheet showing the scoring, etc. Send a large s.a.s.e. if you wish a copy of the results.

Stations planning activity in NJ are requested to advise the EARA by August 1st so that coverage of all counties may be planned.

Logs must be received no later than Sept. 8th and go to: Englewood ARA, P.O. Box 528, Englewood, NJ 07631-0528.

Alaska QSO Party

0200Z Sat. to 0200Z Mon., Aug. 18–19

This is the third time around for this QSO Party sponsored by the Alaska DX Association. All bands will be activated, offering a good opportunity to pick up some of those vacant spots for 5 Band WAS, WAZ, DXCC, etc. The same station may be contacted on each band, c.w. and s.s.b., for QSO credit, but counted only once as a multiplier.

Exchange: RS(T) and judicial district for KL7's. RS(T), QSO no., and state, province or DX country for others.

Scoring: *For Alaskans*—QSOs on 10, 15, and 20 count 2 points. On 40, 80, and 160 they are worth 5 points.

For non-Alaskans—On 10, 15, and 20 QSOs count 5 points. On 40, 80, and 160 they are worth 10 points.

Multiplier: *For Alaskans*—states, VE provinces, and DXCC countries worked on each band.

For non-Alaskans—KL7 judicial districts (1–4) worked on each band.

Final Score: Total QSO points from all bands times the sum of the multipliers from each band.

Frequencies: 10 kHz inside the low edge of each General Class segment, both on c.w. and s.s.b.

Awards: Certificates to the winner in each state, VE province, and DX country. The top Alaskan and non-Alaskan will receive an Alaskan Goldpanner Plaque.

Logs and summary sheets must be received no later than October 1st and go to: Alaska DX Association, Att: Tony Smaker, KL7AF, P.O. Box 1614, Kodiak Island, AK 99615.

Alabama QSO Party

1600Z Sat. to 2300Z Sun., Aug. 25–26

This party is again being sponsored by the Chattahoochee Valley A.R.C. The same station may be worked once on each band and each mode, mobiles on each county change, and Alabama-to-Alabama contacts are permitted.

Exchange: RS(T) and QTH. County for Alabama; state, province, or country for all others.

Scoring: One point per QSO. Alabama stations multiply total by sum of states, VE provinces, and countries worked. All others multiply total Alabama contacts by sum of Alabama counties worked (maximum of 67).

Frequencies: C.W.—3565, 7065, 14065, 21065, 28065. Phone—3965, 7265, 14265, 21365, 28565. Novice—3725, 7125, 21125, 28125.

Awards: Certificates to the top scorers in each state, VE province, and DX country. Also to top scorer in Alabama. Plaques to the overall Alabama and out-of-state winners.

Mailing deadline is September 30th to: Johnny Royster, WA4VEK, P.O. Box 494, Fairfax, AL 36854. Include a large s.a.s.e. for a copy of the results.

All Asian C.W. Contest

0000Z Sat. to 2400Z Sun., Aug. 25–26

The same rules as for the Phone Contest on June 16–17 apply here. See June Contest Calendar for complete rules. Logs for this one must be in the hands of the committee no later than November 30th. They go to: JARL, P.O. Box 377, Tokyo Central, Japan.

Occupation Contest

1800Z Sat. to 2400Z Sun., Aug. 25–26

This is the fourth annual Occupation Contest sponsored by the Radio Association of Erie, PA. The purpose of this activity is to contact other amateurs and exchange occupations.

Exchange: RS(T); your occupation; state, VE province, or DX country.

Scoring: One (1) point for each occupation similar to one you already worked. Two points for each retiree worked. Three points for each new occupation worked. Try to keep occupations general (i.e., engineer, technician, machinist, salesman, etc.).

There is no multiplier. Total QSO points is your final score.

Frequencies: C.W.—40 kHz up from bottom of each band. Phone—3920, 7250, 14300, 21400, 28600.

Awards: None were indicated, but last year certificates were given to the highest scoring stations in each state, VE province, and DX country. A plaque goes to the overall winner.

Mailing deadline for your logs is October 1st to: Harry Arsenault, K1PLR/3, 603 Powell Avenue, Erie, PA 16505.

DARC "Corona" 10 Meter RTTY

1100Z to 1700Z Sat., Sept. 1

This is the third of a series of four 10 meter RTTY contests sponsored by DARC for 1984. The remaining one will take place on November 3rd. Activity, of course, is on 10 meters only in that portion of the band used for RTTY.

Classes: Single operator, multi-operator, and s.w.l.

Exchange: RST, QSO no., and name. U.S. stations will also include their state.

Scoring: One point per QSO. Use the WAE and ARRL country list for your multiplier. W/K, VE/VO, and VK call areas will be considered separate multipliers.

Final Score: Total QSO points times the country and call area multiplier.

Awards: To leading station in each classification.

It is recommended that you use official log forms, which can be obtained from DF7FB. Include an s.a.s.e. with your request. You can also make up your own and include a summary sheet with detailed information.

Reports and inquiries go to: Klaus K. Zielski, DF7FB, P.O. Box 11 47, D-6455 Erlensee, West Germany. Contest entries should be received within 30 days after the end of the contest.

Bulgarian C.W. Contest

0000Z to 2400Z Sun., Sept. 2

This is a world-wide contest open to all, but with emphasis on working LZ's.

Classes: *A.* Single operator, single band. *B.* Single operator, all band. *C.* Multi-operator, all band. *D.* S.w.l.'s. Use all bands, 3.5 through 28 MHz.

Exchange: RST plus your ITU zone.

Scoring: One point for QSO with stations in the same continent (including same country), 3 points if in another continent, and 6 points for LZ contacts.

S.w.l.'s score 3 points if both calls and exchanges are reported, and 1 point if both calls but only one exchange.

Multiplier: Sum total of ITU zones worked on each band.

Final Score: Total QSO points from all bands times the total multiplier.

Awards: Medals to the top three world scorers in classes *A* and *B*. Cup and medals to classes *B* and *C*. Medals to continental leaders and s.w.l.'s.

Use a separate log sheet for each band, a summary sheet showing the scoring, and the usual signed declaration, plus your name and address in block letters.

Contest contacts may be used for the many LZ awards. Write to the BFRA for details.

Mailing deadline for logs is October 5th to: Bulgarian Federation of Radio Amateurs, P.O. Box 830, Sofia 1000, Bulgaria.

YLRL "Howdy Days"

1800Z Wed. to 1800Z Fri., Sept. 5-6

This activity is for YL's, and scores will be based on contacts between YL's only. All licensed woman operators throughout the world are invited to join the party.

All bands and modes 10 through 80 meters may be used. Only one contact with the same station is permitted, regardless of the band. Crossband and Net contacts do not count.

Suggested Frequencies: C.W.—3555, 7055, 14055, 21195, 28195, 28195. S.S.B.—3955, 7255, 14295, 21395, 28595. (Plus or minus 15 kHz.)

Score 2 points for each YLRL member worked; 1 point if it's with a non-member. Therefore, members should identify themselves in the exchange. There is no multiplier; just add the QSO points.

The top-scoring YLRL member will receive her choice of a YLRL pin, charm, or stationery. The highest scoring nonmember will receive a one-year membership in the YLRL.

Submit your original log, no carbon copies. Indicate if you are a member, score your log, and sign the summary sheet.

You are expected to delete all duplicate contacts. For each duplicate contact that is removed by the Committee, a penalty of three additional and equal contacts will be removed from your score.

Logs must be received by October 5th and go to: Marty Silver, NY4H, 3118 Eton Road, Raleigh, NC 27608.

(For the first time the YL's have listed suggested frequencies of operation. I'm sure they will now find participating enjoyable and more productive.—ed.)

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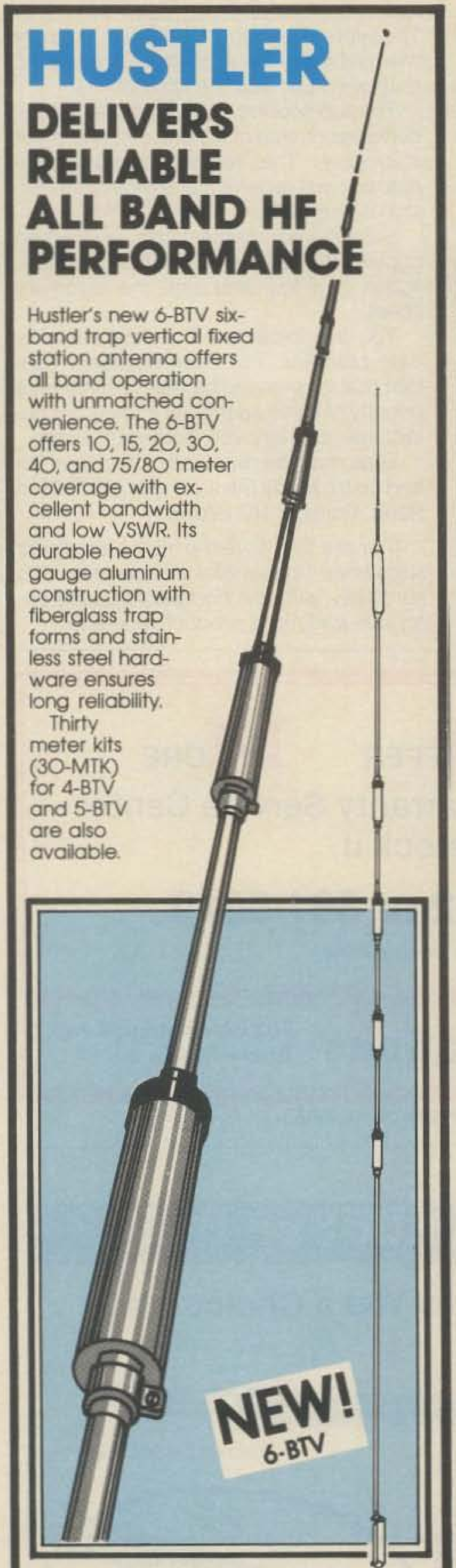

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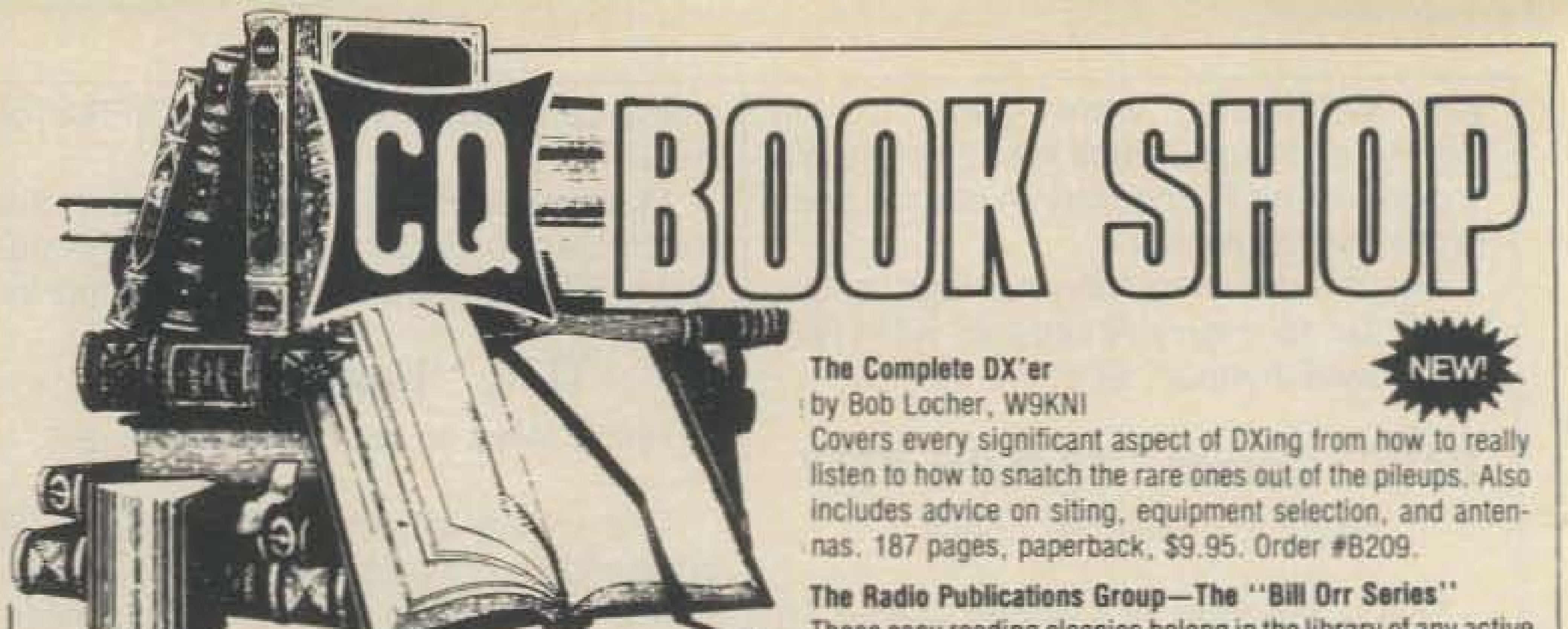

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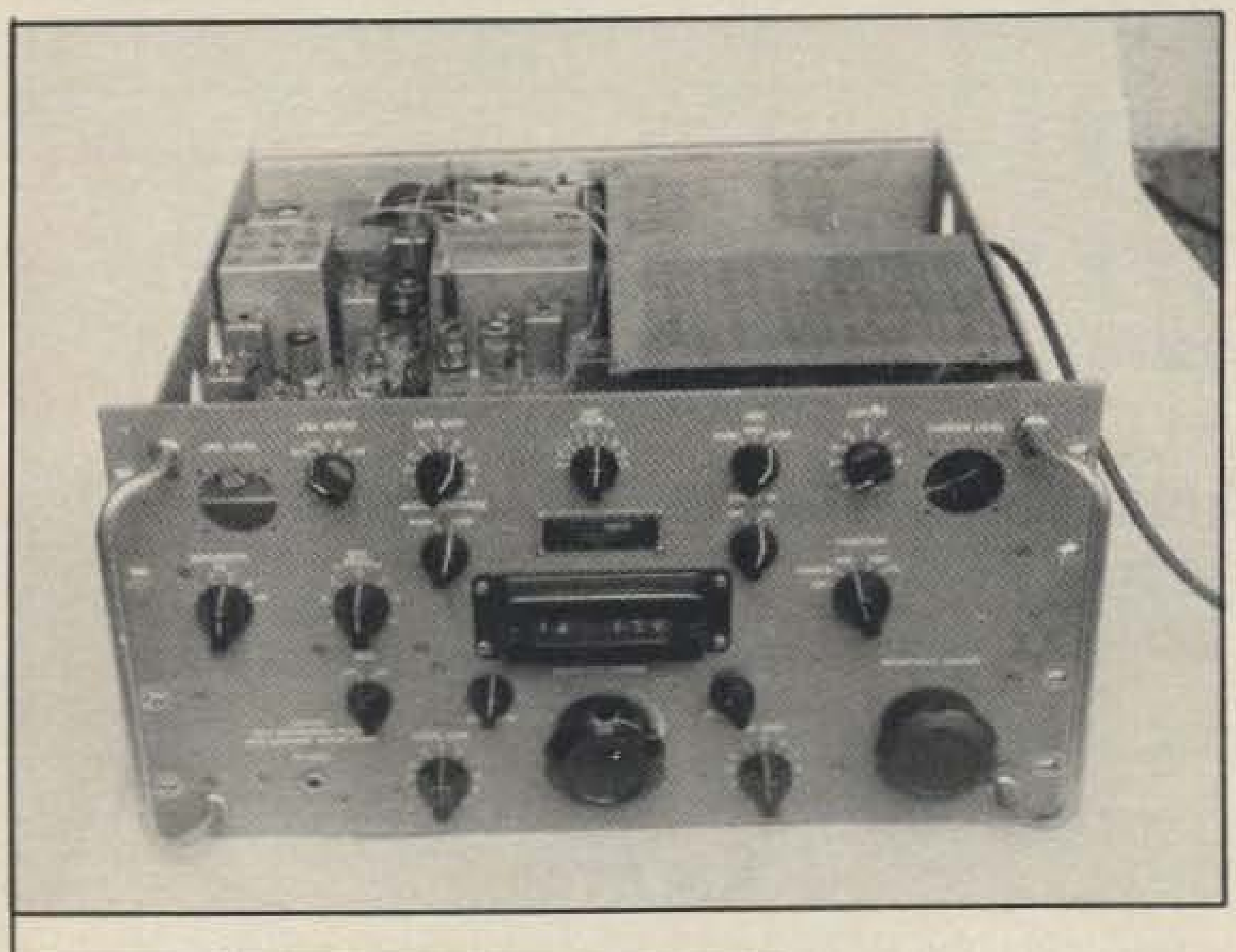

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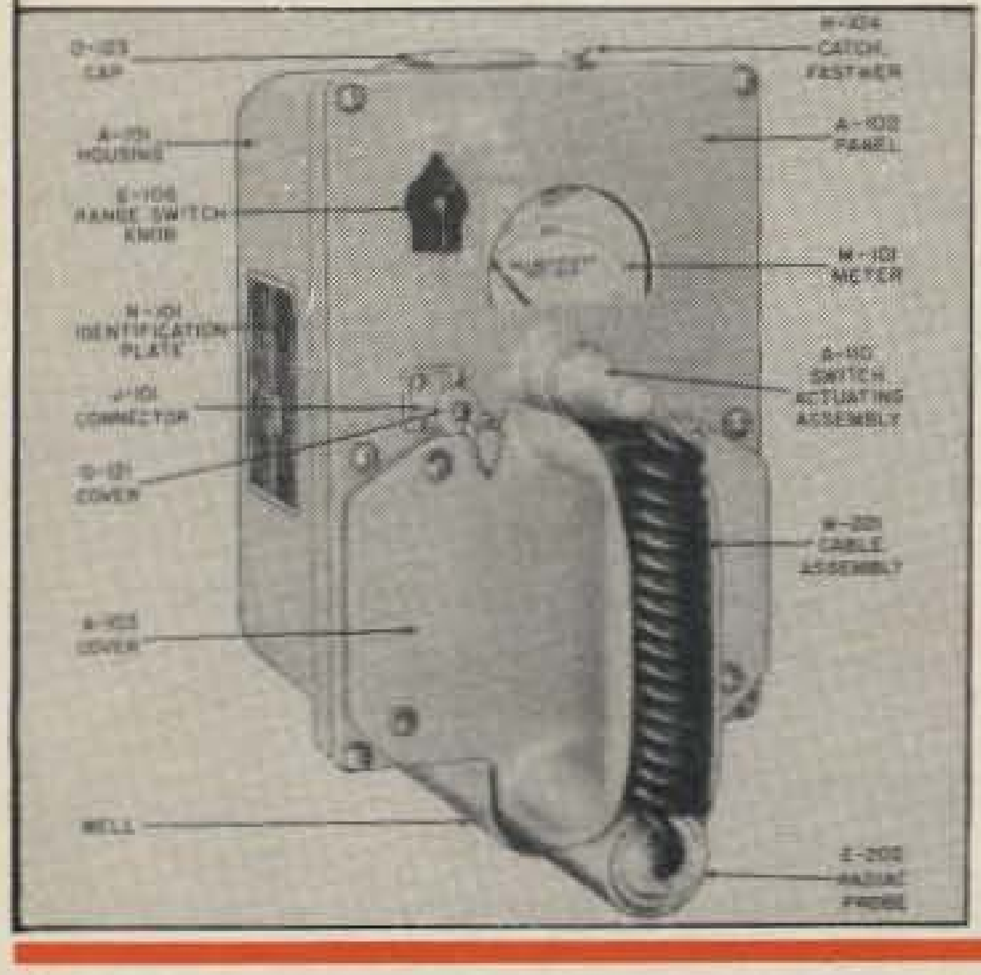

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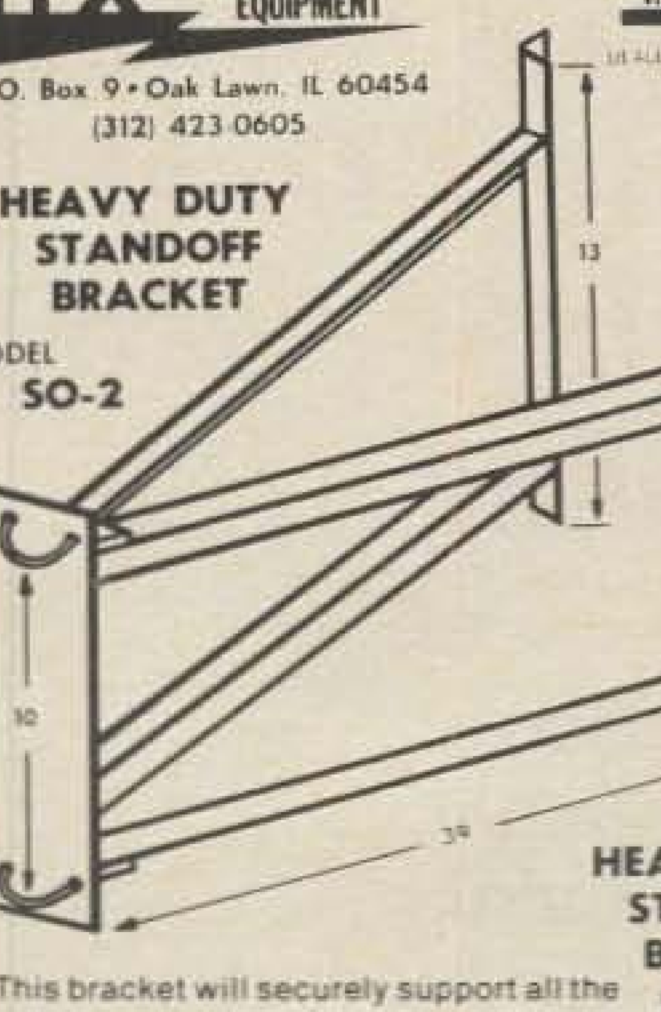

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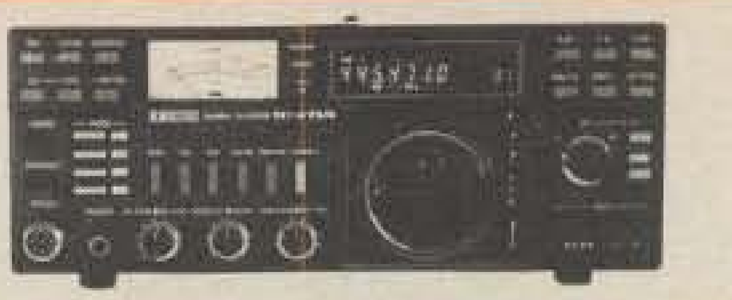
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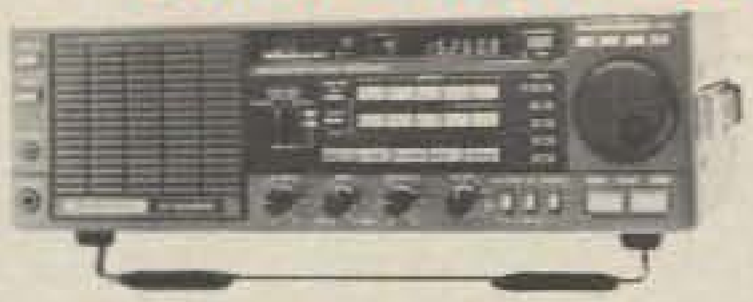
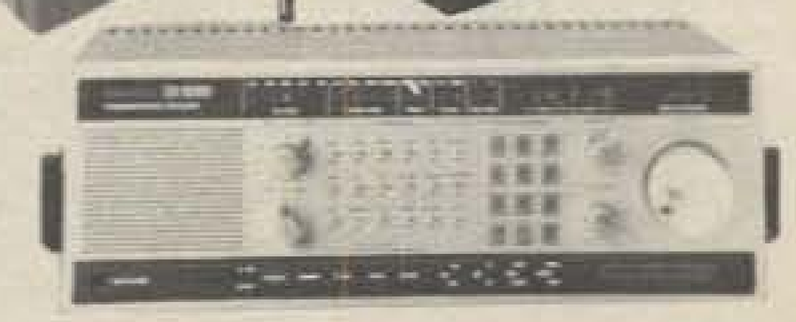

KENWOOD R-2000, R-1000
R-600

YAESU FRG-7700
FRG-7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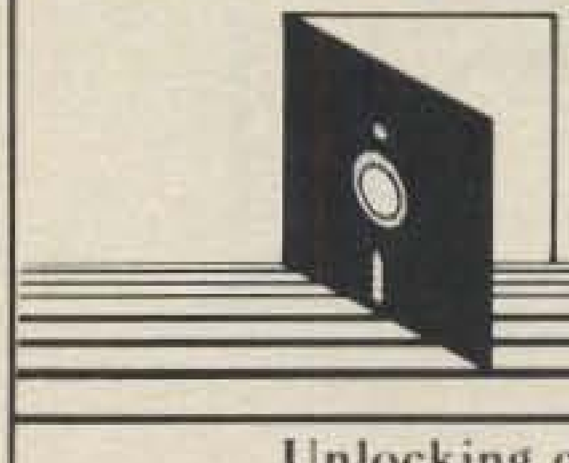

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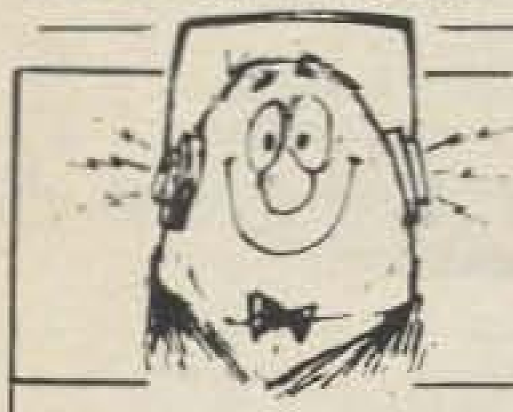

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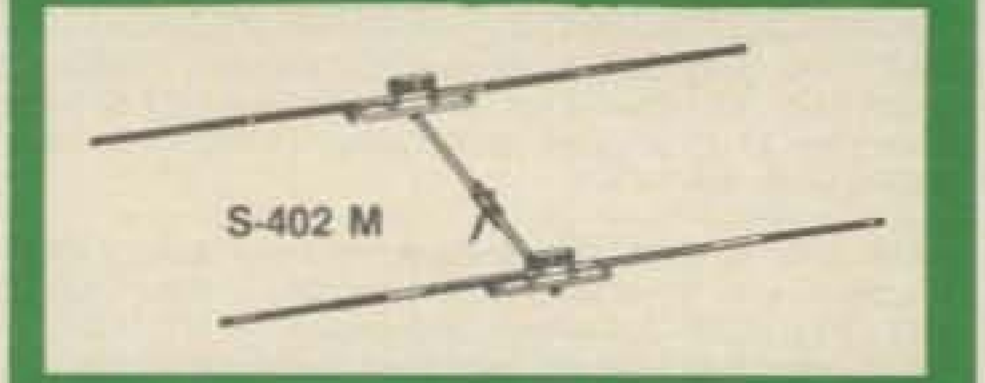

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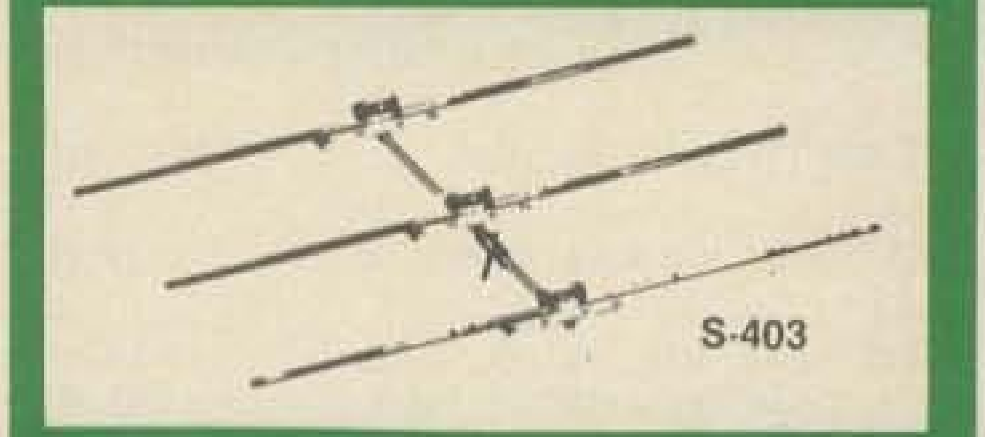

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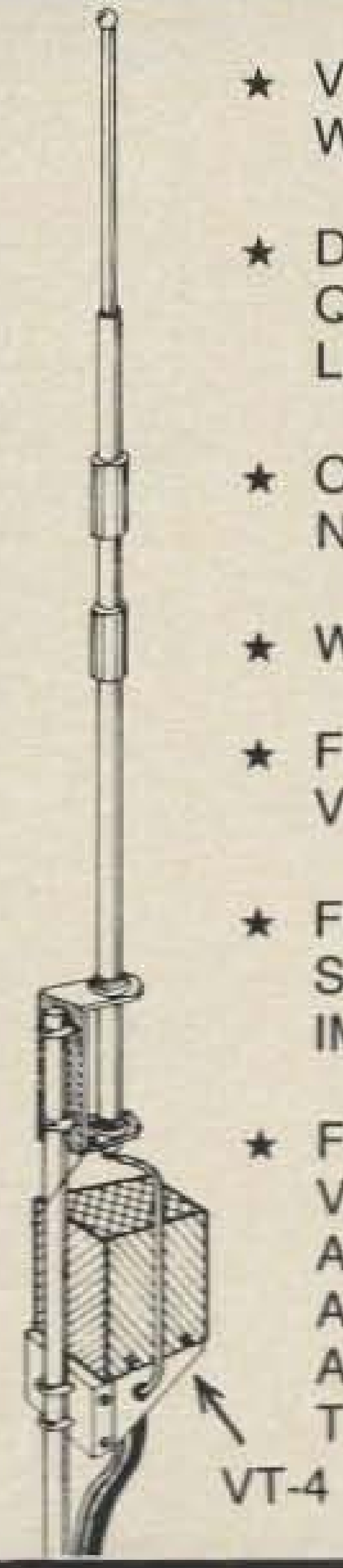

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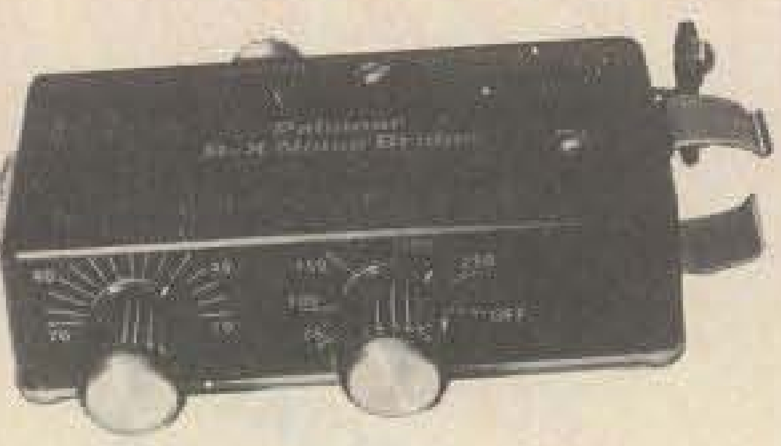
CIRCLE 89 ON READER SERVICE CARD

R-X Noise Bridge



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Advertiser's Index

AEA/Adv. Elec. Applications 10, 11, 62
ARRL 69, 89
All Electronics 58
All-Comm, Inc. 107
Alliance Mfg. 9
Alpha-Delta 130
Aluma Towers 17
Amateur Accessories 91
Amateur Radio Center, Inc. 70
Amateur-Wholesale Electronics 59
Amidon Associates 26
Antique Electronic Supply 128
Astron Corp. 91
Austin Custom Antenna 40
BHC, Inc. 130
Barker & Williamson 102
Barry Electronics 47
Bash Educational Services 110, 111
Bencher, Inc. 64
Birch Hill Sales 126
Blacksburg Group 63
Britt's 2-Way Radio 23
Budwig Mfg. Co. 128
Bullseye Products, Inc. 73
Burghardt Amateur Center 91
Butternut Electronics 109
CQ Book Shop 122
Caddell Coil 131
CeCo Communications Inc. 102
Centurion International 49
Certified Communications 91
ColoRadio Research 76
Computer Trader 124
Cotec 124
Crumtronics 126
Cushcraft Corp. 77
Dentron Co. 63
Discount Discs 116
Doc's Communications 121
Dynetic Systems Corp. 92
EGE, Inc. 73
ENCOMM, Inc. 6, 7
Elephant Electronics 126
EZ/Way Products 105
Fair Radio Sales 113
Fox Tango Corp. 127
G.I.S.M.O. 57
Gem Quad Products 70
Hal Communications 16
Hal-Tronix 58
Ham Mastertapes 43
Ham Radio Center 63, 89
Ham Radio Outlet 12
Ham Shack 127
Harrison Radio 117
Henry Radio 31
Hustler, Inc. 122
ICOM America, Inc. 2, Cov. IV
IIX Equipment Ltd. 125
JL Industries 37
Jensen Tools 70
Jun's Electronics 125
K2AW's Silicon Alley 128
KLM 35
Kantronics 24
Kent NV6C, Wendell 99
Kenwood Cov. II, 1
LaCue Communications 85
Larsen Antennas 97
LaRue Electronics 98
Listeners/Friends Radio Peking 128
MFJ Enterprises 41
Madison Electronics Supply 105
Magnum Distributing Co. 103
Martin Engineering 51
Memphis Amateur Electronics 58
Meshna Inc. 123
Microlog 83
Microwave Filters 42
Midwest Amateur 126
Mirage Comm. Eqpt. 55
Missouri Radio Center 131
Mosley Electronics 111,128
NCG Co. 49
Nemal Electronics 124
Nuts & Volts 126
Nye Co., William 61
PC Electronics 116
Palomar Engineers 8, 132
Paramount Comm./Elec. 107
Parsec Communications 61
Philadelphia Resins 87
Plak, Rudy 125
Polar Research 85
Pro Search 14
QSLs by W4MPY 113
RF Products 105
Radio Amateur Callbook, Inc. 64
Radio Expo 129
Radio World 130
Radiokit 95
S-F Amateur Radio 128
SVM Electronics 126
Sintec Co. 42
Skylane Products 116
Sommer Antenna Systems 81
Spider Antennas 90
TNT Amateur Radio Sales 123
Technical Software Corp. 127
Telco 113
Telex/HyGain 5, 15
Telrex Labs 112
Ten Tec 45
Texas Towers 65, 66, 67, 68
Transleteronic, Inc. 49
Trionyx, Inc. 121
Tuned Antenna Co. 71
UNR/Rohn 33
Universal Electronics 42
VHF Communications 82
Vector Radio 131
VoComm Products 119
W9INN Antennas 130
Westcom 60
Westech 129
Western Electronics 113
Williams Radio Sales 129
Xantek 99
Yaesu Electronics Cov. III

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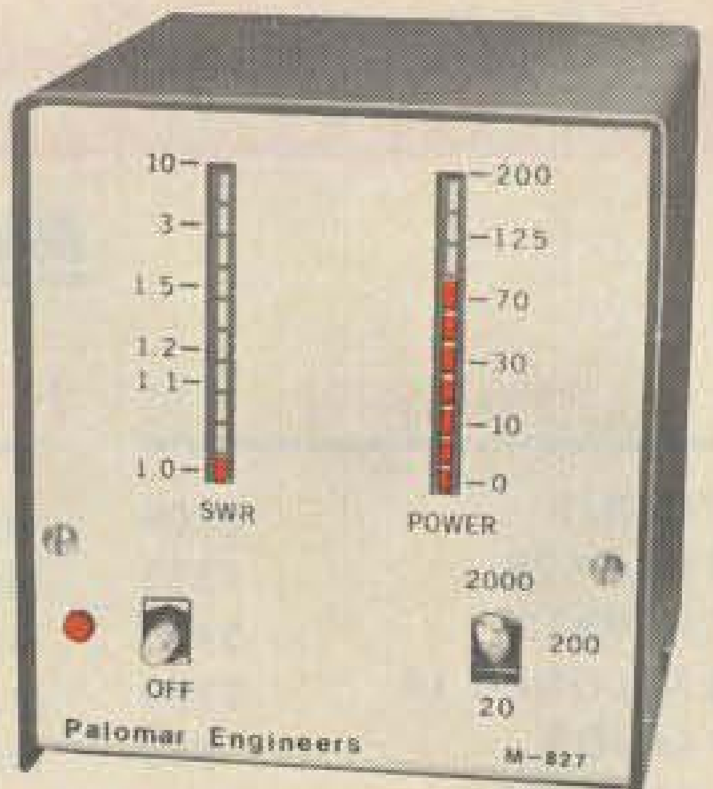

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Full CW QSK, full 100 watts output at 100% duty cycle (SSB/CW/FM), and full microprocessor control with dual VFOs, eight memories with bilateral memory/VFO swap, and personal computer (CAT System) compatibility make the FT-757GX a winner, at home or away.

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FT-203R Line

The Compact Companion

ULTRA-COMPACT DESIGN

Chip components installed by Yaesu's assembly robots significantly reduce circuit board size, resulting in a rugged, reliable transceiver with a weight of only 450g, including the standard FNB-3 battery.

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A VOX (voice-actuated transmit) unit is built-in, allowing hands-free operation when the optional YH-2 Headset is used. Ideal for tower work, public safety, or other applications where manual PTT control is inadvisable. Level control provided.

FULL FLEXIBILITY

Built-in S-meter, thumbwheel frequency programming, HI/LOW power switch, busy channel and transmit indicators are standard. DTMF Encoder versions, as well as 220 MHz and 440 MHz lines, are coming soon!

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IC-GC4
World Clock

ICOM introduces the IC-R71A 100KHz to 30MHz superior-grade general coverage receiver with innovative features including keyboard frequency entry and wireless remote control (optional).

This easy-to-use and versatile receiver is ideal for anyone wanting to listen in to worldwide communciations. Demanding no previous shortwave receiver experience, the IC-R71A will accommodate an SWL (shortwave listener), Ham (amateur radio operator), maritime operator or commercial operator.

With 32 programmable memory channels, SSB/AM/RTTY/CW/FM (optional), dual VFO's, scanning, selectable AGC and noise blanker, the IC-R71A's versatility is unmatched by any other commercial grade unit in its price range.

Superior Receiver Performance. Utilizing ICOM's DFM (Direct Feed Mixer), the IC-R71A is virtually immune to interference from strong adjacent signals, and has a 100dB dynamic range.

IC-RC11
Infrared
Remote

Passband tuning, a deep IF notch filter, adjustable AGC (Automatic Gain Control) and noise blanker provide easy-to-adjust clear reception, even in the presence of strong interference or high noise levels. A preamplifier allows improved reception of weak signals.

SPEECH
1
2
3
M⇒VFO
4
5
6
A=B
7
8
9
A/B
CE
0
ENT

Keyboard Entry. ICOM introduces a unique feature to shortwave receivers... direct keyboard entry for simplified operation. Precise frequencies can be selected by pushing the digit keys in sequence of frequency. The frequency will be automatically entered without changing the main tuning control. Memory channels may be called up by pressing the VFO/M (memory) switch, then keying in the memory channel number from 1 to 32.

VFO's/Memories. A quartz-locked rock solid synthesized tuning system provides superb stability. Three tuning rates are provided: 10Hz / 50Hz / 1KHz.

32 Tunable Memories. Thirty-two tunable memories, more than any other general coverage receiver on the market, offer instant recall of your favorite frequency. Each memory stores frequency, VFO and operating mode, and is backed by an internal lithium memory backup battery to maintain the memories for up to five years.

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CIRCLE 42 ON READER SERVICE CARD

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